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# TUBERCULOSIS
# and How To Combat It

(A Book For the Patient)

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# TUBERCULOSIS
# AND HOW TO COMBAT IT

# TUBERCULOSIS
# AND HOW TO COMBAT IT

CALIFORNIA

## A BOOK FOR THE PATIENT

BY

FRANCIS M. POTTENGER

A.M., M.D., LL.D., F.A.C.P.

Monrovia, California

ST. LOUIS
C. V. MOSBY COMPANY
1921

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# INTRODUCTION

Intelligence is the most potent factor that can be directed against disease. This principle has always been my guide in dealing with tuberculous patients. No question asked by an earnest patient is too insignificant for an answer, and no fact that will aid him in recovering health should be withheld from him.

Since tuberculosis is an infection which starts in childhood and remains throughout the life of the individual, and particularly since regaining and preserving health depend so much upon an intelligent understanding, it is especially necessary that tuberculous patients should be instructed as to the nature of the disease and the measures which have proved of value in its prevention and treatment. The physician who treats tuberculosis then naturally becomes his patient's instructor in health problems. Instructions to patients usually take one of three forms; instructions given to the individual patient; instruction by talks or lectures; and instruction by books and pamphlets. The beneficial influence of instructive talks to sanatorium patients is generally recognized. They are followed by an improved morale, an increased interest, a more satisfied and more optimistic spirit, and a greater determination to cooperate in the cure.



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## *Introduction*

The present book is published at the solicitation of my patients in order to put in a permanent form talks which have been delivered to them from time to time. They are given out in this form in the hope that they may also be of help to others who are seeking information regarding tuberculosis and its cure.

It has been my aim to explain things in a simple manner, to give the physiologic reason for the things that must be done, and the things that must be avoided, so that the patient may follow intelligently and not blindly. It is further hoped that the physiologic facts here given will be of sufficient interest to make the book acceptable to medical men who do not have the time to read more extended works.

The matter treated covers a variety of subjects, which have been chosen because they include most of the inquiries made by my patients thus: 1, simple truths about the disease; 2, the mode of action and reason for using the common measures which have proved of value in treatment; 3, a discussion of the common symptoms which are a source of concern and worry to patients; 4, weather conditions and ways of adapting one's self to the various changes; 5, the patient's part in cure; 6, the environment in which treatment is to be carried out; 7, measures for the prevention of the spread of infection; and

8, certain problems in which the patients are particularly interested.

In Chapters XXXI, XXXIV and XXXV, I have freely drawn from chapters dealing with the same subject in my large book, Clinical Tuberculosis; the remaining chapters are all written expressly for this book.

It is not intended that this book should take the place of a physician, for I consider him the most important factor in the treatment of tuberculosis. He is the one who must instruct and guide the patient, encourage him during his treatment, and in many instances force him to get well. Its purpose is to aid and supplement his instructions and make both his and the patient's task easier.

F. M. P.

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# TUBERCULOSIS AND HOW TO COMBAT IT

## CHAPTER I

## WHAT IS TUBERCULOSIS?

Tuberculosis is an infectious disease produced by the tubercle bacillus. This is a small rod-shaped microorganism. It belongs to the vegetable kingdom although it is often jocularly spoken of as being a "bug." It is about $\frac{1}{80.000}$ of an inch thick and from $\frac{1}{8.000}$ to $\frac{1}{16.000}$ of an inch long. It can be seen only by the use of a microscope which magnifies it several thousand times. Its detection is facilitated by staining with analine dyes.

Tuberculosis is not inherited, but acquired after birth. When bacilli enter the body as described in Chapter IV they begin to make a place for themselves and to make the tissues around them favorable to their life and growth. They form chemical substances which attempt to injure the tissue cells. The tissue cells in turn form substances which injure them; and a struggle for mastery ensues. If the body cells are successful the bacilli are de-

stroyed; if unsuccessful, the bacilli succeed in injuring the cells and in drawing from them substances which are necessary to their own growth and development. They make a nest for themselves where they can live and multiply. The layman can gain a fair idea of the manner in which tuberculosis affects the tissues by the mould seen in bread and cheese. The disease spreads from small foci to neighboring tissue; and, if unhindered, gradually involves larger and larger areas.

The bacilli grow and multiply; and the tissue cells, irritated by the bacilli, enlarge and call to their aid the white blood cells. This multiplication of bacilli and heaping up of body cells forms a small nodule or "tubercle" from which the disease receives its name—tuberculosis. This tubercle is at first very minute, so minute that it can be seen only by a microscope. But it grows, and after two or three weeks it may be seen by the naked eye.

This tubercle is much like a pimple or small boil although at first it is much more tiny. It may go through all of the changes that affect the pimple or boil. It begins as a slight thickening of the tissue. It grows, and may soften in the center and rupture. But while a pimple or boil will go through these changes in a few hours or days, a tubercle requires weeks, months or even years.

When a boil softens in the center, and breaks down it is because the pus germs in it have multiplied and produced substances which have the power to destroy the tissue cells. The same thing is true of the tubercle. Sometimes a boil or pimple will make its appearance but fail to soften or break down—just remain as a hard nodule for a short time and then disappear. In such instances the germs have been unable to make the tissues favorable to their growth and multiplication. So is it in tuberculosis. Early in the disease, comparatively few of the tubercles soften, in fact, they may be present for years and not make enough progress to cause any appreciable destruction of tissue.

When the bacilli are not able to multiply readily and destroy the enveloping cells and cause softening of the tubercles, it is evident that the patient is showing resistance. When, however, multiplication of bacilli and softening of the tubercule takes place rapidly, then it is evident that, for the time being, the resistance of the tissues has been lowered, relatively, giving the bacilli the advantage. One of the chief aims of treatment is to keep the resistance of the body cells high so that the tubercle bacilli cannot multiply and, destroying the cells which surround them, spread to new tissue.

Patients suffering from tuberculosis usually have a wholly inadequate idea of the nature of their disease. They imagine that they have a small area of disease as large as a dime or a quarter; and I am sorry to admit that this idea is often given them by members of the medical profession. The truth is that the disease, when it causes the patient to consult a physician, is usually well scattered. There may be hundreds, thousands, or even hundreds of thousands of these tiny tubercles in the tissues; and the reason that a physician is being consulted is usually because the bacilli are multiplying, producing destruction of body cells, and being implanted in new tissue. From the standpoint of healing it is far better to have thousands of scattered tubercles in the tissues with areas of good lung and normal blood supply between them than to have a smaller number aggregated together in one area. Small tubercles which are close together often fuse and form larger ones. Sometimes tubercles in large areas fuse together, soften, and then rupture, forming a large cavity.

Tuberculosis may affect any part of the body—the glands, the joints, the bones, the kidneys, the larynx, the intestines—but is most prevalent in the lungs.

When tubercle bacilli have once gained access

to the body tissues and made conditions favorable for their growth and multiplication, one of three things happens: (1) the resistance of the tissues increases and proves to be sufficient to destroy the bacilli—that is, the power of the body cells to produce defensive substances is raised to the point of overcoming the bacilli so that the process heals; or (2) if the protecting qualities of the tissue cells are not sufficient to destroy the bacilli, they may be sufficient to hold them in check and prevent further multiplication, so that the process becomes quiescent; or (3) the bacilli may find conditions favorable to their development, and multiply, either immediately or later, and burst through the cell wall which the tissues have built around them and spread, producing new foci, thus causing an active advancing disease. When this latter process becomes extensive and continues for a long time the patient fails in strength, loses weight, and his vital powers become exhausted. This condition has long been known as phthisis or consumption.

Tuberculosis is a disease which many physicians as well as laymen find difficulty in understanding. Its chronicity; its peculiar nature of being active for a time and then becoming quiescent again; the fact that it can be active and be a real source of danger to the patient while he feels comparatively

well; are characteristics not commonly found in the acute infections with which we are more familiar.

In order to comprehend tuberculosis it is necessary for one to think in periods of months and years. The changes which take place in a simple boil on the skin from the time that the pus germs enter the tissues until the boil forms, ruptures, and heals is usually only a few days; the time from infection to healing in pneumonia and typhoid fever is only a few weeks; the time for a tubercle to go through the same changes, however, may be anywhere from a few weeks to many years. Bacilli do not multiply as readily as people believe. They have a way of becoming active, increasing in number for a time, and then quieting down again and remaining dormant. This inactive period may last for years, and yet the bacilli be alive and able to grow and multiply if conditions favorable to them become established.

Tuberculosis, then, is a disease which runs an uneven course, with periods of activity when the bacilli are multiplying and throwing out poisons into the tissues alternating with periods of quiescence when they are not increasing in number and not giving off poisons. Prior to the time when the disease becomes well established as an active

process the periods of quiescence are far longer than the periods of activity. In fact, the periods of activity may only appear every few months: or, even years may intervene between different active periods. When the disease becomes markedly active, on the other hand, and the tissues begin to soften and break down, such periods of activity may continue for several weeks or even for many months at a time.

After the stage of breaking down of tissue has once been reached, and even when destruction has been extensive, the tendency for the process to heal is still evident. If the patient's fighting forces can be so marshalled that they largely prevent the bacilli, which are bursting forth from the softening tubercles, from finding lodgment and forming new tubercles, many patients may still go on to an arrestment of their disease. This fact is evident to all who have an opportunity to observe many cases of advanced tuberculosis. A patient may have chances for an arrestment of his disease, even though he has had fever and coughed and raised for a time, provided too much tissue has not been destroyed and provided his body cells have not been injured beyond the point of regaining their function when the active process has attained quiescence.

## CHAPTER II

## WHO MAY HAVE TUBERCULOSIS?

Anyone may have active clinical tuberculosis. No one is too old or too young; too fat or too thin; too strong or too weak; too rich or too poor. It comes to the city dweller and also to the dweller in the country. No one is immune. I have found active disease with bacilli in the sputum of two octogenarians. One man was eighty-one years of age and had been well and hearty until six months before consulting me. The other man was eighty-four. He had lived in the mountains for many years of his life, had been a great walker, and even boasted that he could do ten miles a day up to within a year of the time that I found him suffering from an extensive disease of both lungs. I have found active disease of the lungs in children under one year. I have seen numbers of patients who weighed more than two hundred pounds and found that they at times were obliged to struggle as hard to secure an arrestment as those of slighter build. Even at times people break down with active tuberculosis who have apparently kept all the commandments laid down by antituberculosis workers. They have slept out of doors,

eaten good food, avoided excesses, gone to bed early and yet they have become ill of the disease.

The explanation of these apparent inconsistencies is not readily given; yet, now that we understand the nature of tuberculosis better, particularly as to the time when infection occurs, and how the disease spreads in the body, such occurences are less puzzling.

Infection takes place most readily and most commonly in the early years of childhood. Of those in the cities who frequent our large clinics and hospitals nearly all are infected with tuberculosis before they attain the age of fifteen years. While the children of parents who are in better economic condition and those who live in the country are not infected to so great an extent, yet the percentage of infections among these is also high. The percentage is greatest in homes where there is some one suffering from an open tuberculosis, that is, where some one is expectorating sputum containing bacilli. Here, hardly any child, who associates long with the patient, escapes. We are conservative in saying that the great majority of all children are infected with tuberculosis before they are fifteen years old. In fact, when we consider the great numbers of people who have open tuberculosis, and the great numbers who have it without knowing it, and the carelessness manifested by them

either knowingly or ignorantly, it is plain that one generation continuously sows the seeds of infection for the next. When we add to this the milk from tuberculous cows which is fed to our children without being properly sterilized, one hardly sees how any child can escape infection.

While the percentage of infections among children is high, the proportion of deaths is not so great as might be expected. These early infections are for the most part produced by comparatively few bacilli, and while they succeed, at least for the time being, in making the tissues favorable for their growth, they do not succeed in making them favorable for a rapid and continuous growth. However, a massive dose of tubercle bacilli, gaining entrance to the body of a child under one year of age, will cause death in nearly every instance. While early inoculations of less serious degree are producing infection they are at the same time creating in the child an immunity. At the same time that the bacilli are growing and multiplying they are also sending out substances into the tissues which are the products of their growth, or substances which result from the destruction and solution of their bodies, which stimulate the body cells to put up a greater defense; and very often the child soon gains the advantage, and the bacilli are for the time being,

or it may be permanently, held in check. Thus infection and increased resistance on the part of the child go hand in hand. Without an infection, the child would not need, neither would it develop, a specific power to destroy the tubercle bacillus.

In many cases where the child is not able to destroy the bacilli, he is able to prevent them from multiplying for a time. Under such circumstances they lie in the tissues surrounded by a wall of cells. They may remain inactive in this manner for years; in fact, throughout the individual's life. On the other hand they may become active at any time if conditions favorable to their growth prevail.

Postmortems on large numbers of adults who die of diseases other than tuberculosis show that a tuberculous infection of the lungs exists in about one-half. Many of these infections are slight in character. Of those showing evidence of the disease, it is healed in one-third, quiescent in one-third, and active in one-third. In how large a proportion of those cases showing quiescent tuberculosis, the disease would have become active, and in how large a proportion it would have healed had the individual lived longer, we have no way of knowing. But the number of cases of active tuberculosis found, and the possibilities of further activity in those who were at the time quiescent, is

sufficiently great to show that almost any one may have clinical tuberculosis.

From these statistics we can see how widespread is the infection. What causes the infection to heal in one body and to produce an active disease in another is difficult to understand. It is also difficult to explain why the disease will become active at one time and then become quiescent again in the same body. We say that the patient's resistance has broken down; and we can often find that he had been working too hard, had been nervously depressed, had previously had some depleting disease, or had been given to debilitating excesses. But there are many cases of tuberculosis that appear when none of these debilitating conditions have existed. This shows us that "resistance" is a condition which does not always depend on the big things such as work, worry, excesses, and depleting disease, but may be a condition within the body itself, a state of the body cells and tissues. We are prone to look for causes without the body when they are often within. If the patient has indigestion it is natural for him to think that the disturbance was due to eating something that did not agree with him. He rarely considers what is just as often true, that he did not agree with the food. When we consider what a wonderfully complex mechanism the human body is, should we won-

der that some of its intricate parts or systems now and then go wrong? Should we not rather expect this to happen oftener than it does?

So when we consider that bacilli enter the tissues of practically all persons and produce infections in probably more than three-quarters of them, and cause infection in the lung in one-half of all who reach adult life, we can understand that the seed is sown widely in the human race, and that when the soil is ready it will take root and grow, and that the harvest will surely follow. While this harvest may not necessarily be in the proportion to which the class represented bears to the population as a whole, yet it will consist of old and young, rich and poor, fat and thin, strong and weak, country dwellers and city dwellers, those who live exemplary lives and those who indulge in excesses. All things else being equal, however, the more healthful the conditions under which the individual lives, and the better he conserves his strength, the less likely he is to suffer from clinical tuberculosis.

## CHAPTER III

## WHAT IS THE SOURCE OF INFECTION?

When Koch discovered the tubercle bacillus in 1882, he supplied the knowledge which exploded the theory of tuberculosis being an inherited disease, and furnished the fundamental facts which proved that it is an infection which takes place after birth.

It has been proven that tubercle bacilli do not multiply outside of the body of their host except as they are cultivated artificially in incubators. There can be no common source of the disease then except the bacilli which are in the bodies of men and animals. There are three common types of tubercle bacilli; one which affects human beings, another which affects cattle, and a third which affects birds. Aside from the one which normally affects human beings, the one which produces tuberculosis in cattle may be transmitted to man and must be taken into consideration in any discussion of human tuberculosis. Those which affect birds are of little or no danger to human beings. Therefore we believe that human tubercle bacilli and bovine tubercle bacilli are the two types which are re-

sponsible for practically all of the tuberculosis found in the human race.

There has been much controversy during the past two decades regarding the relationship of bovine tuberculosis to human infection; and the relationship cannot yet be said to be definitely settled. Experiments have shown that a large proportion of active tuberculosis in children is of the bovine type, but that little of the disease found in adults answers to the bovine characteristics. Investigators have placed the relative proportion of bovine infection to human infection among human beings, as one-twelfth and eleven-twelfths respectively.

It is doubtful whether these figures are correct. Tubercle bacilli can be made to grow upon many different kinds of soil or media, as they are called, in the laboratory. In changing from one soil to another they alter their form and characteristics of growth. It is entirely possible, even probable, that that is what happens to the bovine tubercle bacillus when it enters the human body and starts to grow upon human soil. To my mind the circumstances which make this seem very probable are the facts that nearly all of the one-twelfth of tuberculosis which is definitely recognized as being produced by the bovine bacillus is found in childhood and the eleven-twelfths recognized as being due to the human bacillus is found largely in adults. We

believe today that it is the infection which is taken into the body during childhood that produces the clinical tuberculosis in adult life. The bacilli which are thrown off from the lungs of the adult human being are direct descendants from those which entered the child's body during its early years. We cannot conceive of it being probable that bovine bacilli should cease to live when the age of fifteen is reached, leaving the entire field during adult life to those of the human type; but it seems wholly probable that bovine bacilli after growing in the human tissues for years should be forced, the same as they are when changing from one soil to another in the incubator, to change their form and growing characteristics to conform to the requirements of their new soil.

It is very desirable that this question be settled, yet it cannot be done with the knowledge that we possess today. If, however, only one-twelfth of the cases of human tuberculosis are from tuberculous cattle that should be enough to cause tuberculosis to be eradicated from dairy herds; but if that is not enough, and it does not seem to be, then the possibility or probability of a much larger proportion being of that origin should emphasize the importance of eradicating tuberculosis from the milk-producing cattle. There are about 120,000 deaths a year from tuberculosis in the United States. If

one-twelfth of these are from bovine tuberculosis that means that 10,833 lives annually are sacrificed to infected milk. Even though a much larger percentage of human tuberculosis than one-twelfth may be due to the bovine bacillus the human bacillus is unquestionably still the chief source of danger; and the principal source of infection is those human beings who have the disease in its open form. A patient with open active tuberculosis who coughs and expectorates may cast out from a few to billions of bacilli a day. One patient studied by us expectorated 36,000,000,000 of bacilli in a single day. While that is an unusually large number, patients will commonly expectorate several millions a day. Patients who reach the stage where they are casting off bacilli will usually continue to do so for many months and sometimes for many years. When we consider how many have the disease without knowing it and how careless the average human being is about his expectoration, it is evident that bacilli are widely distributed, and the knowledge that nearly all children are infected is not surprising.

Milk is a universal food among children, and it is necessary to guard its purity with the greatest care. Dairy herds are prone to be infected with tuberculosis. Many fine looking and large producing cows are tuberculous. The greatest danger of

infecting milk is when the udder is tuberculous. The cow, however, does not expectorate when the lungs are infected but passes the bacilli through the bowel and unless care and cleanliness is used in milking, which is not always the case, milk may become infected even though the udder is not diseased. It is estimated that from 20 to 30 per cent of the dairy cows of Great Britain are infected with tuberculosis. The proportion in the United States is probably about 10 per cent for the whole country, although 20 to 30 per cent of the cattle in the dairy herds which supply the City of New York reacted to tuberculin, in a widespread tuberculin test conducted in 1907. 100 samples of milk taken in the open market in New York City by Park in 1908 showed 12 per cent infected with tubercle bacilli. Some cities have run higher than this, even as high as 20 per cent.

Is it not strange that the public does not demand pure milk for children? Certified milk from tuberculin tested cattle is available in many cities, but the cost is too great for the poor. There should be some wise and just plan devised for ridding the herds of all infected cattle. This should provide at least partial compensation to the owner for the animals slaughtered in the interest of public good. Until such a measure is enforced milk should be pasteurized, unless it is definitely known that it

comes from herds which are free from tuberculosis. Neither must we neglect cream, butter, and cheese as sources of infection. Since pasteurization of milk does not remove this danger, this fact emphasizes the importance of eradicating tuberculosis from the dairy herds.

Jex Blake gives the following instructions issued by the British National Association for the Prevention of Tuberculosis for the treatment of milk in the home, so as to destroy any tubercle bacilli that it may contain and at the same time preserve the taste of the milk.

1. Use a double milk sauce pan, or, if this cannot be obtained, put the milk into an ordinary covered sauce pan, and place it inside a larger vessel containing cold water.

2. Put the vessel on the fire, bring the water up to boiling, and maintain it at this point for four minutes without removing the lid of the inner milk pan.

3. Cool the milk down quickly by placing the inner pan in one or two changes of water without removing the lid.

4. When the milk has cooled, aerate it by stirring well with a spoon.

A comprehensive program for the prevention of tuberculosis must have three purposes: (1) the re-

duction of the numbers of bacilli which produce infection; (2) the increasing of the resistance of the individual so that he destroys the invading bacilli or overcomes infection after it has taken place; and (3) the removal of children from the environment of those ill with open tuberculosis and the prevention of their consumption of infected milk.

To attain the first and third purposes the tuberculous patients must be sought out and so instructed and treated that they will not infect others. They should especially be separated from children who are most susceptible to infection. Tuberculosis must be eradicated from dairy herds; but until this is done, milk which is not known to come from tuberculin tested herds should be pasteurized.

In attaining the second purpose all measures for the betterment of the human race have a part,—hygienic care and feeding of babies, ventilated school rooms, play grounds, parks, better and more healthful homes and workshops, adequate wages, regulation of age of workers, and hours of labor, temperance, avoidance of excess, in fact all those activities which make up the usual program of social welfare workers. The discussion of these, however, does not properly belong to this chapter.

## CHAPTER IV

## HOW IS TUBERCULOSIS TAKEN INTO THE BODY?

It is not necessary to discuss fully the relative merits of the theories which have been propounded to answer the question as to how tubercle bacilli enter the body; yet, if one knows the various ways in which bacilli may be taken into the body, he will be more intelligent in his opinion of the value of methods for prevention.

There are two principle schools of thought on this subject. One holds that most infections take place through the air passages, the bacilli being breathed into the bronchi with the inhaled air. The other believes that most infection takes place through the intestinal canal. They believe that the bacilli, pass through the mucous membrane, enter the lymph channels and eventually reach the same structures as though they entered directly by the air passage. Bearing upon this point of controversy it might be added that bacilli have been introduced into animals experimentally in many ways; by the stomach and intestinal tract, by the rectum, through the eye, through the peritoneum; and, the interesting thing is, that no matter where

the bacilli entered, they made their way to the lung and bronchial glands, the same as though they were injected directly into the trachea and bronchi.

Fortunately the tubercle bacillus is not as virulent as is generally believed, and the resistance of the human race is probably greater than is generally recognized. Otherwise there would be little chance of any one surviving with the present careless method of caring for human beings and animals that are casting off tubercle bacilli.

Bacilli come from ruptured tubercles, the same as pus comes from a ruptured boil. Many of the bacilli are dead when they are expectorated or when they are cast out of the body of the cow. Many of them, however, are alive and able to produce the disease if they become implanted in suitable tissues in sufficiently large numbers.

Bacilli are quite tenacious of life under certain conditions. They will live in dark damp places for months and still be able to grow and multiply. We do not know just how long they will live outside of the body and be able to produce infection, but we do know it is a rather long time. Experiments have shown them to be able to do this three months or more after being expectorated. Fortunately, they are quickly killed by direct sunlight and are also killed, although more slowly, by diffuse light.

There are three principal ways in which human

tubercle bacilli are transmitted from the person who expectorates them to the one who receives them. First, the method which was championed by Cornet and is called the "dust" theory. He taught that the sputum expectorated by the tuberculous patient dried and passed into the air as dust and that the bacilli were inhaled into the lungs with the inspired air. This was so plausible that it was readily accepted. Fluegge recognizing the fact that many of the bacilli which enter the air as dust are dead, believed that they must enter the human body in a more virulent form in order to produce disease. He propounded the theory of "droplet infection." He experimented and found that when people cough and sneeze or even talk that they throw out a fine spray of mucus from the mouth and nose. From the patient with open tuberculosis the spray is made up of particles of sputum which often contain tubercle bacilli. Fluegge held the opinion that these particles being moist and the bacilli being fresh from the tuberculous ulcerations, and not having been injured by the light or any other outside influences, should be more dangerous to those who inhale them than those contained in dried sputum. The third way in which human bacilli are taken into the body is through food, particularly milk, soiled hands, toys, and so forth.

In the first two ways mentioned, through "dust" and "droplet infection," it might seem that the bacilli were most apt to be inhaled directly into the lungs, but this may not be at all true. Bacilli taken in, in either of these ways, may be deposited on the surfaces of the mucous membrane of the throat and be swallowed the same as those which enter the mouth through contaminated hands, toys and other articles, and through milk.

There are roundabout ways by means of which bacilli will finally find their way to the lung whether they are inhaled or swallowed, and to me the route through the intestinal tract seems more apt to be the common way of infection than the one by direct inhalation into the air passages. But no matter what happens to the bacilli after they enter the nose or the mouth, it is important to know that they can be taken into the body through dust or droplets or through contaminated articles, and that they can produce infection whether they enter the air passages with the inhaled air or the gastrointestinal tract by being swallowed.

The bacilli which come from cattle cause infection almost wholly through milk and milk products, consequently through the intestinal tract. Flesh used as food is rarely infected; and, if it were, the bacilli would be destroyed by cooking. Infected milk, however, which is so often used raw is un-

doubtedly a great menace to the lives of the little ones.

Young children are most prone to become infected. The bacillus finds lodgment in their tissues more easily than it does in those of older children or adults; partly because, after coming in contact with bacilli, small lesions are produced which may or may not heal, but which leave the individual with an increased resistance or heightened immunity. Therefore, the child's resistance to tuberculosis increases with years, and it is the small children who should be most carefully guarded against infected milk and milk products and the immediate contact with tuberculous patients. The small child is also untrained in habits of cleanliness. He spends a great deal of his time on the floor where danger of infection is most pronounced, or he sits in the lap of the infected person. He puts his hands and anything he picks up into his mouth; and if they are soiled with bacilli the opportunity for infection is furnished.

## CHAPTER V

## THE RELATIONSHIP BETWEEN TUBERCULOUS INFECTION AND TUBERCULOUS DISEASE.

It is evident from the preceding discussion that tuberculous infection and tuberculous disease, that is clinical tuberculosis, are not the same. It is further evident that all tuberculous infections do not become clinical tuberculosis. It is necessary then that these two conditions be understood and that their relationship to each other be comprehended.

Tuberculous infection may take place any time during the life of the individual provided enough bacilli are introduced into the body when conditions are favorable for their growth and development. Regardless of this fact students of the tuberculosis problem are practically of one accord in believing that nearly all infection takes place in childhood and that this infection is the source from which the bacilli spread to produce the active disease in later life. This belief is supported by the facts that tubercle bacilli may remain in the tissues for years and still be able to produce the disease, and that tuberculous infection occurring in

the body creates within that body a certain degree of resistance or immunity to the further activity of the tubercle bacillus, in the same manner that vaccination creates an immunity to smallpox.

This immunity, which is only partial, closes the portals of the body more or less effectually against invasion of bacilli from without. With those bacilli which are already in the body, however, the case is different. They may at any time during the life of the individual become active and escape in large numbers, through the walls which confine them, into the blood stream; and, circulating throughout the body, they may be either destroyed or find lodgment in the small capillaries, usually those of the lung. Here they become implanted, multiply, and produce a new area of infection. In this way the infection in childhood becomes not only responsible for the clinical tuberculosis in childhood but also for the clinical tuberculosis in adult life. From the time of infection to the time when the disease becomes recognized, weeks elapse in childhood and months and years in adults.

In this, tuberculosis is very different from the ordinary acute diseases with which we are familiar, such as whooping cough, pneumonia, scarlet fever and diphtheria. The causative germs in these diseases are of short life. They are taken into the body and produce their respective diseases within

a few days or at most a few weeks, and the germs responsible for the disease are eliminated from the body tissues. Tuberculosis, on the other hand, is so slow of development and the bacilli are so long lived and so resistant to the defensive forces of the body that months and years may intervene between the time of infection and the time of clinical disease.

During this long period between infection and active tuberculosis the bacilli are shut up in the body surrounded by a wall of cells. They are viable and only awaiting an opportunity to become active. Just what it is that makes it possible for these imprisoned bacilli to escape and become active we do not know, but it has to do with the natural defensive forces of the body. Certain things, like overwork, inanition, excesses, living under unhygienic conditions, and debilitating diseases, are apparently responsible for many outbreaks of active tuberculosis.

When tuberculous infection becomes active or appears as a clinical disease it is no longer the apparently harmless process which lies quiescent for years as mentioned in our previous dicussion; it is then a serious disease. It is already destroying the wall of cells which has kept the bacilli imprisoned, and they are escaping to produce new areas of infection; and if the process is not soon checked

tuberculous abscesses will form which will rupture and produce cavities in the tissues. These cavities may be so small that they can hardly be seen or they may be as large as an egg; or several large ones may fuse together and even occupy almost an entire lung.

When these abscesses form, the patient is suffering from active advanced clinical tuberculosis. This stage of the disease usually comes years after infection has taken place; and often several years after the disease began to spread from the place of the initial infection. The early spreading in the lung, like the early infection in childhood, usually occurs without the knowledge of the individual.

Patients may recover both from the small infections and from those which are wide spread. The difference between the patient who has recovered from tuberculous infection and the one who has recovered from tuberculous disease is one of degree. One has recovered from a small infection, the other from a larger one. Since recoveries take place by encapsulating or building a wall of cells about the bacilli, and since the bacilli remain within in a viable condition, it is the part of wisdom for those who have made a recovery from an infection, especially an extensive one, to live a life which will minimize the danger of future extension.

## CHAPTER VI

## HOW DOES TUBERCULOSIS AFFECT THE PATIENT?

If the tubercle bacilli which produce the first infection are taken into the body during childhood as we believe today; and if the bacilli which produce the clinical disease, it may be many years after, are succeeding generations of the bacilli which entered the body in childhood, as we further believe, how is one to know when a quiescent, apparently harmless, infection is becoming an active disease and assuming an alarming state? A satisfactory answer to this question would be a boon to humanity, but it cannot be given.

As a rule, when the disease begins to spread from the primary focus, which is usually in the lymph glands, to new tissues, it extends slowly. The patient rarely knows of its presence until many points of infection have been established; so the knowledge is gained, probably as a rule, months, and often years after the bacilli have escaped from the primary focus.

A disease makes its presence known by symptoms. Symptoms result from a disturbance in the

normal action of a part or organ. Symptoms may either show themselves in the organ affected or in other organs. If one burns his hand the pain is felt in the hand; if one has tonsillitis the pain and disturbed function are both in the throat and in other organs; being produced in the former by the fact that it is the seat of the inflammation; and in the latter by the poisons which enter the blood stream and through nerves which connect these organs with the tonsil. If one has an ulcer of the stomach the function of the stomach and other organs which are in reflex connection with it through nerves may be interferred with and pain may be felt on the surface of the body between the margin of the lower ribs on the left side, and the midline of the body. Pulmonary tuberculosis produces symptoms both on the part of the lung and on the part of other organs. The function of the lung is to take up oxygen from the air and transmit it to the blood; and to take poisons from the blood and give them back to the air. The lung area is much larger than it need be. In fact one can get along fairly comfortably on one-half of his lung area; and can exist on about one-twelfth. On this account a tuberculous involvement of considerable proportions can be present in the lung without producing a recognizable interference with its functions. A tuberculous infection, however, if

it becomes extensive or, if not extensive, if it becomes markedly active, may produce symptoms: (1) of a general nature due to the bacillary poisons; (2) in other organs which are of a reflex nature; and (3) due to the process itself. The fact that these may not appear until the disease becomes extensive is one thing that makes early pulmonary tuberculosis difficult of diagnosis. It may steal on like a thief in the night, accomplishing its purpose before making its presence known. This difference between tuberculosis and the commonly known acute diseases is due to the fact that tuberculosis is a chronic disease and the bacilli multiply slowly while in the acute diseases they multiply quickly, often in a few hours.

There is no one symptom which is always present to let the patient know when active tuberculosis is present. Tuberculosis manifests itself in many different ways. While patients as a rule feel tired and show a decrease in strength and endurance, and are troubled by a cough; neither these nor any other individual symptom is always present. Sometimes the disease shows itself in one way and sometimes in another.

Patients often have a preconceived notion that they must have a cough or spit blood or have a pleurisy or lose weight in order to be tuberculous. This is based on old ideas of the disease, long dis-

proven. Those who are leading in the fight against tuberculosis recognize that early diagnosis is necessary in order to give the patient the best chance of cure; consequently they are ever striving to provide new and better methods of diagnosis. Careful study of large groups of patients has shown that the symptoms are variable and that in one patient one group shows itself first and in other patients another group. While there are many symptoms which are commonly met, yet there is no order in which they will appear.

There are some twenty-five or more symptoms which may be present in early active pulmonary tuberculosis; but we must not expect them all to be present at one time; nor must we expect them all to necessarily be present in any given patient, or to appear in any given or set order. In one patient one group of symptoms will predominate, in another, another. At one time a patient may show a certain symptom, and at another time, it may be absent.

Several years ago I suggested that all of the common symptoms of tuberculosis were produced in one of three ways: (1) by the poisons (toxins) which are absorbed; (2) reflexly through nerves; and (3) by the presence of the disease itself. This gives the following grouping of symptoms, which may be recognized by the patient.

## *Tuberculosis*

**GROUP I**

***Symptoms due to the absorption of toxins***

**Tired feeling**
**Lack of endurance**
**Loss of strength**
**Feeling of being run down**
**Nerve instability**
**Loss of appetite**
**Reduced power of digestion**
**Loss of weight**
**Rapid heart action**
**Night sweats**
**Rise in temperature**
**Changes in the blood**

**GROUP II**

***Symptoms produced in other organs or tissues reflexly, through the nerves***

**Hoarseness**
**Tickling in throat**
**Cough**
**Digestive disturbances (burning in stomach; gas; colicky pains; constipation).**
**Heart may be reflexly slowed when patient is at rest; although it is usually rapid on exertion.**
**Pains in shoulder and chest.**
**Flushing of face.**

**GROUP III**

***Symptoms due to the direct presence of the disease in the tissues***

**Frequent colds, of a bronchitic nature, accompanied by cough, sometimes expectoration, tired feeling, and lack of appetite;**
**Spitting of blood;**
**Pleurisy.**
**Sputum.**

While tuberculosis is due to a microorganism the same as such diseases as pneumonia, typhoid fever, diphtheria, tonsillitis, and whooping cough; it differs from them, as previously mentioned, in that the bacillus grows and multiplies slowly while the organisms which produce these other diseases grow and multiply rapidly. As a rule in the acute infections the microorganisms which cause them are taken into the body and followed within a few days

by symptoms of toxemia such as mentioned above. The disease runs its course in a few days or a few weeks and the patient either gets well or dies. There is, as a rule, in these acute infections, only one period of toxemia, unless relapse or complications occur. Clinical tuberculosis, on the other hand, is apt to be a succession of periods of activity and periods of quiescence. When the disease becomes active, toxins may pass into the blood stream in small quantities for a long period and produce many symptoms of a mild character found in group I; or the disease may be intermittently active, showing fever and other symptoms of a toxic nature for a time and then being free from them, this occurring at intervals sometimes regularly at other times irregularly; or a third type, a continuous toxemia with severe symptoms may be present for weeks or months at a time. All of these types of active disease may alternate with periods free from fever and other toxic symptoms. They may show when the patient is exercising, and not when he is kept confined to his bed. Active tuberculosis is not necessarily accompanied by a rise of temperature, or by other toxic symptoms. During the period when the patient is free from toxic symptoms the disease may only be quiescent. This is shown often in practice. A patient will have fever one week and be free the next, although the extent

and severity of the disease as a whole has not changed. Only some small area in which the bacilli became especially active has changed.

From what has been said it is now evident that tuberculosis is a disease showing many different methods of onset. The common types are as follows:

### 1. The Neurasthenic Type

One in which mild symptoms of group I predominate. These patients have an unstable nervous system. They are called neurasthenics. They feel tired on exertion or even without it. They have little power of endurance and poor strength. They, as a rule, have poor appetites and digestion; and are often below their normal weight. The pulse is more rapid than it should be, particularly on exertion. They often have a temperature slightly above normal. They often appear pale and anemic.

Such patients are not well, yet they often go from physician to physician without a diagnosis being made; and with little help being offered. They are often considered as malingerers and are treated without sympathy. Every such patient demands a diagnosis as well as the acute medical or surgical patient.

Such patients are not all tuberculous, far from

it; but a large group of tuberculous patients manifest these very signs and are overlooked until they lapse into invalidism. Many of them break down with frankly active tuberculosis later, making the diagnosis clear.

This neurasthenic type seems to be more common in women than in men. When caused by tuberculosis it is often due to a succession of advances of the tuberculous process in the lung tissue. At first no symptoms are noted, but gradually as the disease becomes more active, sufficient toxins are set free into the blood stream to make an impression on the cells of the nervous system; and these in turn become injured and more irritable than normal. Patients who suffer from this form of the disease may now have disturbed function on the part of one organ and again on the part of another one.

Aside from the distinctly neurasthenic type of tuberculosis, the toxic group of symptoms may appear in company with other symptoms which dominate the type; such as the type in which bronchitis, pleurisy, digestive disturbances, or hemorrhage ushers in the active disease.

### 2. The Bronchitic Type

In the bronchitic type, irritation in the larynx, cough and expectoration dominate the picture. The

patient, however, usually has slight rise of temperature, malaise and disturbances on the part of the stomach and bowels at the same time. These attacks of bronchitis sometimes are repeated at frequent intervals, the patient saying that he does not get over one "cold" before he has another. At other times they are infrequent, months passing between attacks. Such patients usually say that their "cold goes down on the chest."

### 3. The Gastrointestinal Type

This type is usually one of chronicity. The bacilli have not been able to maintain a high degree of virulence, yet the body cells have not been able to overcome them. The result is that the disease process in the lung reflexly disturbs digestion in the same way that it is disturbed in the patient who has a diseased appendix or gall bladder. The patient may have a burning in the stomach, gas pains, colitis and constipation. Many patients with this type suffer at the same time from mild toxic symptoms such as are mentioned in group I above, and belong to the neurasthenic type.

### 4. Circulatory Type

Those of this type do not make up a very large group. The patients suffer from unstable heart

action, particularly palpitation and rapidity of beat. They usually have mild toxic symptoms also. In some cough and other reflex symptoms are present.

### 5. Blood-Spitting Type

In this class, the first symptom that makes the patient aware of the presence of a disease of the lungs is spitting of blood. It may come on without warning; or, as is often the case when the patient has his attention called to the matter, he can see that he was gradually losing strength or had been subject to colds or had other suspicious symptoms for some time previously. This group of cases is sometimes accompanied by the toxic symptoms mentioned above, sometimes it is not. Spitting of blood should always make the patient willing to accept the diagnosis of tuberculosis unless some other definite cause can be found. Unless another cause is definitely found, it demands an immediate chest examination by one who knows tuberculosis and is not afraid to tell the patient the truth.

It is well for the patient to know that there are a few other causes which will produce blood spitting; however, he should also definitely understand that it means probable tuberculosis, unless another definite cause is found.

### 6. Pleuritic Type

Pain in the side due to tuberculosis of the pleura is often the first sign of an active tuberculosis. It is generally accepted that when the pleura fills with fluid (water on the lung) it is due to a tuberculous process which is active at the time. It is not so generally known, however, that the form of acute pleurisy which manifests itself by a sharp, cutting or stabbing pain, even though no fluid is present, is also usually due to active tuberculosis. There are also many dull aching pains particularly about the upper part of the chest which may be due to tuberculous pleurisy.

This type of tuberculosis may be accompanied by sufficient toxemia to produce symptoms found in group I. It is also often accompanied by irritation in the throat and a hacking cough.

Pleurisy, blood spitting, and repeated attacks of bronchitis are so commonly due to active tuberculosis that it is incumbent upon a patient always to have his chest examined when these are present; and it is the duty of the examiner to consider them as being due to active tuberculosis unless he can find other satisfactory and positive causes for them.

I have now briefly discussed some of the common ways in which tuberculosis makes itself known to

the patient. If anyone is suffering from the symptoms described in the above three groups; or if he is suffering from groups of symptoms here mentioned as producing types of onset of the disease; he should at once be thoroughly examined. He should not have this examination to prove to himself that he has not the disease; but he should approach the examiner recognizing that his symptoms are very suspicious and that with some types they are all but conclusive. An early diagnosis of tuberculosis often means the difference between a life of usefulness and a life of invalidism, often the difference between life and death. If the disease is present the diagnosis should be sought for and welcomed.

cies of the body, unless these latter can be greatly augmented.

When tuberculosis advances to the point of producing symptoms and making the individual aware of its presence it is approaching the time when the struggle for mastery between the bacilli on the one hand and the patient's defensive forces on the other, will, if unchecked, soon be decided in favor of the invading bacilli. Therefore early active or clinical tuberculosis must be given serious consideration. It is not a foe to be jeered at, but one which calls for the bravest and most intelligent opposition.

The seriousness of tuberculosis is rarely apparent when it begins to produce symptoms. The patient may look and feel well most of the time. He may only feel tired and run down; and this may last only for a short period of time. He may have what seems to be a cold; but this may soon clear up and leave him in his usual state of health. If he coughs or spits blood or has pleurisy; these, as a rule, only last a short time and may give way to his former condition of health. Is it any wonder then, that it is difficult to make the patient accept the diagnosis of the presence of a disease which is so serious that it is responsible for one tenth of the deaths of the human race? Is it any wonder that it is so difficult to persuade patients at this

time to give up their work and adopt a regime which largely isolates them from their affairs and friends? These questions must be answered in the negative. Yet the greatest hope of cure of tuberculosis depends upon early diagnosis and early intelligent treatment. Just to the extent that the patient will accept early diagnosis and early treatment will the battle waged against active tuberculosis be successful.

The time when the apparently harmless foci which have existed in the lungs for an unknown period have taken upon themselves such a degree of activity as to endanger the patient's life is not easy to determine. Observation leads to the opinion that comparatively simple measures for bettering one's condition and raising his resistance, such as a temporary rest, or a change of occupation, or a tonic, will check the progress of early tuberculosis and cause the process to become quiescent in a small percentage of patients. These measures will cause it to be temporarily checked in a larger percentage. Unfortunately, we have not the power to tell what persons can check the disease by simple measures, and the price is too great to pay for a mistaken judgment; consequently every patient suffering from early clinical tuberculosis should recognize the seriousness of his infection and act accordingly.

While simple measures may produce a good re-

sult in a number of cases of early tuberculosis; the best approved and most aggressive measures when intelligently and conscientiously applied will restore from seventy to ninety per cent to health. While this large percentage of those suffering from early tuberculosis can obtain a favorable result, and be restored to their family and friends without being seriously crippled; it is a much smaller percentage that can secure an arrestment after the disease has become advanced, and many of those will have their efficiency lowered.

This appeal would be sufficient to cause those who have the diagnosis made early to accept it and demand immediate intelligent treatment, if only they believed in its truthfulness.

Tuberculosis has many sides other than that of the result obtained. It always has a financial side. The loss of time, the cost of treatment, the reduced efficiency which interferes with the patient's earning capacity, are all important items.

It requires from six to eight months of treatment, on the average, to obtain a favorable result in an early case of tuberculosis, and the patient is ready for full work in from six months to a year more. It requires from six or seven to nine or ten months of treatment to obtain a favorable result in a moderately advanced case, and the patient is ready for partial work in from six months to a year more.

It requires from nine or ten months to two or more years to produce a favorable result in a patient suffering from far advanced tuberculosis; and, after a good result has been obtained, the patient must return to work slowly; and, if he will be safe, he must avoid undue stress and strain for practically the remainder of his life.

These facts emphasize the importance of early treatment of tuberculosis, and appeal strongly for its early recognition. Its early recognition, however, is of little value unless some plan is adopted that will lead to its healing. A patient with early active tuberculosis, owes it to himself, to his family, and to the public at large to adopt a program which will give himself the best chance of overcoming his disease.

Early tuberculosis offers the greatest hope of cure, and we should strive to bring the disease under intelligent treatment during this stage; yet for those in whom the process has advanced farther, there is sufficient hope to make it worth while to put forth an earnest effort to get well. Many advanced cases may be brought to a satisfactory issue; but it requires more time, calls for greater sacrifice, demands a greater financial outlay for a result which is not so satisfactory.

There is no magic remedy for the cure of tuberculosis; no specific which we may inject and ex-

pect to produce a definite result. Healing comes in the average case only after it has been earned by the faithful observance of a carefully thought out program. An intelligent physician who understands tuberculosis and the tuberculous patient, and a patient who will conscientiously cooperate will master early tuberculosis in nearly all instances, and the advanced disease in a sufficiently large percentage of instances to warrant the optimism which is now generally associated with the treatment of this disease.

## CHAPTER VIII

## WHAT TO DO WHEN A DIAGNOSIS OF TUBERCULOSIS IS MADE

When a diagnosis of active tuberculosis has been made, no matter how slight the lesion seems to be, the patient should lose no time in securing competent medical advice as how best to overcome it.

Whether a patient will get well or not depends much upon the treatment instituted and the manner in which it is carried out; but, all things being equal, it depends most upon the earliness with which treatment is begun.

So again, let it be emphasized that the patient must lose no time after active tuberculosis is diagnosed. He should consult some one who understands tuberculosis. The fact that a man has a diploma to practice medicine does not guarantee that he knows tuberculosis. He must be interested in the disease and give it some special study if he wishes to render efficient service. Many general practitioners are fully capable of giving good advice to tuberculous patients and treating them successfully; but many others do not give the subject more than passing notice in their study. These

latter should and usually will refer the patient to some one who is capable of rendering good service.

Specialists who advertise in daily papers and in other ways should be avoided for they represent commercial organizations for the sale of wares and are not reputable physicians. Such men degrade the profession and are not recognized by medical organizations. Their main purpose is not to render service, but to relieve the unsuspecting patient of his money.

Patent medicines should also be avoided. They often give a false security until the time for help has passed. There has been no single remedy found which will cure tuberculosis. Its healing is brought about by living a life so directed that the patient's resistance is kept high, over a period of time sufficiently long to allow the process to heal. All advertised remedies which promise a cure for tuberculosis should be considered fraudulent and should be avoided by those who desire to get well.

When an individual finds that he is suffering from active tuberculosis he must first of all endeavor to gain a conception of his disease, its nature, and the measures which should be followed in order to obtain a cure. The economic side of the question is as important as the medical; for both must be considered together. What a patient should do, and what he can do, are often different.

The treatment of each case is an individual matter; and the best treatment for the individual patient is the best that his economic condition will permit him to carry out.

Should a patient go to a sanatorium? By all means if he can. There is no other place where patients can get so good an idea of the disease, tuberculosis, as in a well-conducted sanatorium; no place where conditions are so favorable to cure; and no place where they will learn so well how to live the life necessary to retain health when once regained.

If one cannot go to a sanatorium, however, he does not need to despair. The treatment will be more difficult; the patient will not have the help of trained attendants nor the moral support of others making the same fight and he will have to use stronger will power in order to carry out his program; but it can be done.

To get over tuberculosis one must be willing to make sacrifices; but he should be comforted by the fact that they are temporary in character; and that if made early in the disease they may prevent a total wrecking of life and its aspirations.

## CHAPTER IX

## OPEN AIR

Open air is generally spoken of as a "cure" for tuberculosis. That the facts do not warrant such confidence should be thoroughly understood. Open air is only one of the many measures for increasing the functional capacity of the body cells; and to the extent to which it is able to do this does it aid the human body in overcoming tuberculous infection. It has no direct action upon the tubercle bacillus. It must be classed along with good food, light, proper regulation of the patient's rest and exercise, properly directed psychotherapy, and other measures which have a beneficial influence upon the body cells. The reason that it has been heralded as a cure is because of its universality, its relative ease of application, and its general action. Its action is not limited to any particular organ, or any particular group of cells, but is exerted upon all the functions of the body, the same as rest and exercise, food, air and water baths, and psychotherapy.

While of all the factors which operate in the aid of the patient to overcome tuberculosis, fresh air

is generally given the first place, yet it must be understood that it has no specific effect upon the disease process. Unless this is understood, too much reliance will be placed upon it; and other measures which may be of great value to the patient, and which, if utilized, might insure his recovery will be withheld from him. Open air alone may help a certain percentage of patients to overcome their disease, yet there are many others who will require the assistance of other measures in order to be able to gain mastery; so it is very important that the exact part played by open air in the cure of tuberculosis be well understood. Where it, alone, will not cure, it may do so, if assisted by other helpful measures such as suitable diet, proper guidance, the intelligent application of rest and exercise, the institution of psychotherapeutic measures, tuberculin, or the improvement of the function of some particular organ that may be working against the individual.

Regardless of the limitations of open air treatment, its employment marks one of the greatest advances in the therapeutics of tuberculosis. It seems strange in this day of sanitation to think that the use of so simple a measure in the treatment of tuberculosis has been employed for less than three-quarters of a century.

Owing to the peculiar pathologic changes which

occur in tuberculosis, when patients are left to themselves, they are apt to think that they suffer from frequent colds. These "colds" are in reality acute inflammatory changes in the tuberculous tissue. Since they come more or less frequently, the patient is inclined to believe that they are a result of exposure; consequently, he learns to fear draughts and open air. So, naturally, prior to the time of the teachings of sanitarians, the tuberculous patient shut himself up in order to avoid these supposed sudden colds.

George Bodington, an inhabitant of Sutton Coldfield, Warwickshire, England, was one of the first men to combat these established ideas by the establishment of a fresh air institution. He employed open air, and wrote regarding his method in 1840, two decades prior to the time of Brehmer. He said: "Cold is never too intense for a consumptive patient; the apartment should be kept well aired, so that it should resemble the pure air of the outside, pure air being used in the treatment as much as possible." This statement startled not only laymen but medical men as well; and, like all revolutionary ideas, reacted upon its originator. Bodington was maligned, and spoken of as being insane, and so bitter was the persecution on the part of the medical profession that patients were afraid to stay in his institution. His experiment

did not last long; and the "open air idea" made no further particular progress until Brehmer started the first permanent sanatorium nearly twenty years later.

It would seem that so simple a thing as fresh air would appeal to everyone; but not so. Even in spite of the world-wide campaign for fresh air in the homes, schoolhouses, and workshops, it still meets opposition on every hand. The medical profession, as a whole, is way behind its leaders in the use of it, and carries out the principles with great timidity.

It is not always easy to live in the open air. In cold rigorous climates the question of securing sufficient fresh air in the house is very difficult of solution. Fresh air is looked upon by many, who prefer comfort to hygiene, as being unnecessary and a scientific process of freezing. The action of fresh air is as marked upon the nontuberculous as upon the tuberculous. When patients are taken from closed rooms and put in the open air, whether it be the child at school, the worker in the shop, or any inmate of the home, the effect is usually prompt and the change is evident in a general improvement in metabolism. The patient's appetite increases; his digestion becomes better; the desire for sleep is increased, and sleep proves to be more

refreshing; and the tone of the entire organism is improved.

Open air does not furnish an equal stimulus for all patients suffering from tuberculosis. On those who have previously lived in closed rooms and who have been deprived of fresh air to a great extent, the effect is usually most marked. On the other hand, when those people who are accustomed to live in the open air develop tuberculosis, this measure must be supplemented by others in order to produce an adequate defense. Under these circumstances a beneficial result cannot be obtained by open air alone, because the disease has developed in spite of it. The patient has already had fresh air; and, if he is to have a stimulation of his vital forces approaching that which fresh air supplies to the one who is not accustomed to having it, it must be obtained by the application of other tonic measures. Open air, then, is not a cure for tuberculosis, but an aid to the vital forces; and it should be supported by other measures that will help.

It has long been taken for granted that the sole remedial factor in open air is oxygen and that the deleterious factor to be avoided in closed rooms is carbon dioxide; but recent study shows that this is not true. There is probably as much oxygen in the stalest confined air as the individual can use; and there is nearly always an amount of carbon dioxide

below the quantity necessary to cause injury. The belief in oxygen has been so strong that we have been taught that oxygen in the form of ozone is particularly valuable in the treatment of tuberculosis; but it now seems positive that the beneficial action of open air in improving the general body tone is apart from the oxygen or $CO_2$ content present.

Ideas concerning the manner in which open air acts upon the patient have changed very much since it first began to be employed.

Air is taken into the body for the purpose of furnishing oxygen, which combines with the food and burns it up, thus liberating energy for the production of work. Oxygen is necessary to life and is always present in the tissues. If there is the slightest lack of it, the individual involuntarily breathes deeper or more quickly and furnishes the required amount. If one breathes deeper or more quickly than necessary, more oxygen enters the blood than the tissues can take up and the patient becomes dizzy; and involuntarily breathes less frequently and more shallowly until the surplus is used up.

This shows that it is not the great amount of oxygen in the "open air" that causes it to be of such great value in the treatment of tuberculosis. It also shows that deep breathing cannot have a cura-

tive influence by bringing more oxygen into the tissues.

It was further thought that in some way getting more oxygen into the lungs would kill the tubercle bacilli, but now this idea is also untenable. While the breathing of good, pure air, free from chemical impurities and bacterial contamination is desirable, yet we now know that the markedly beneficial effect of open air is not dependent upon its large oxygen content but upon the stimulation of the fine nerve endings in the skin.

Important contributions to our knowledge emphasizing this fact have recently been made by several groups of workers. These workers have made most careful studies to determine the beneficial and detrimental influences of air, and have brought forth proof of the fact that the chief value of open air as contrasted with confined air depends upon its action upon the surface of the body and varies with its temperature, humidity, and movement, and their effect in relieving "heat stagnation in the body and monotonous conditions of cutaneous excitation."

The fallacy of the theory that the evil effects of air depend upon the impoverishment of oxygen is shown by the fact that oxygen in the most crowded room is never diminished by more than one per

cent, yet patients will live and be comfortable when the oxygen is reduced ten per cent or more.

The evil effect of an excess of carbon dioxide in the air has also been assumed, but not proved. Even in rooms where the air would be considered unusually stale, there may not be an increase of more than one-half of one per cent of carbon dioxide; and furthermore, it has been shown that when there is an excess it cannot enter the body. When the amount of carbon dioxide in the air increases, pulmonary ventilation also increases, the patient breathes more rapidly and more deeply. There is no marked effect shown upon the individual while in an atmosphere in which the percentage of carbon dioxide is increased greatly, provided the air is not stagnant. Such an increase as is found in ordinary rooms would not of itself exert any appreciable influence upon the human organism.

The question of expired air containing organic poisons has also been investigated by various observers and it seems it can be dismissed as unsubstantiated. The physical effects of air, however, are extremely important. While the deleterious effects of confined air, from the standpoint of its chemical constituents, seems to be disproved, the physical effects of confined, stagnant air are assuming more and more importance.

The physical effects of air depend upon the de-

gree of temperature, its water content, and the degree of air movement. When an individual is surrounded by dead air, without movement, and a warm temperature containing considerable moisture, conditions are present which prevent the elimination of heat, moisture and poisonous substances from the body. Such a condition produces deleterious influences in two ways; first, it prevents the elimination of harmful products; and second, it fails to furnish the surface stimulation necessary for hastening general cellular activity. The result is that the individual shows some of the following symptoms: feelings of discomfort, oppression, headache, faintness, and drowsiness. The evil effects of this may be mitigated to a certain extent even without admitting outside air by keeping the air in motion as by the use of a fan. Thus electric fans render very valuable service in a closed room, and add greatly to the individual's comfort and well being; but the best method of ventilation brings in fresh air from the outside.

Individuals who live in badly ventilated rooms with their bodies surrounded by stale air, lack nerve and mental stability as well as physical tone. They fail to digest and assimilate their food properly, consequently suffer from a low state of vitality. Other conditions being equal, the converse is true of those who live in the open. Their cellular

activity is stimulated and their nerve and physical tone is greatly improved.

Inside air may have as much or nearly as much oxygen as outside air, yet if the air is stagnant the patient will not feel so well. On the other hand a patient who does not react to cold, and who cannot adjust himself to the changes of a rigorous climate may be better off, until such time as he can increase his resistance, in a *well ventilated room with air circulating freely about him,* than in the open. Open air should surround the patient with tuberculosis for a large portion of each day if his reacting powers are sufficient to stand it; if they are not he should be sheltered somewhat, but still be supplied with moving air. There is quite an opposition to drafts on the part of people, yet cross-ventilation is the best ventilation that can be employed as a remedial measure; and, with care in its application most patients may be made immune to any deleterious effects that may be at first noticed. It would often be disastrous to have the patient be the guide as to when open air should be used and when ventilated apartments should be substituted. This rests upon the judgment of the physician.

The motion of the air not only acts beneficially upon the patient, stimulating the nerve endings in the skin and reflexly producing beneficial stimula-

tion of the function of the various tissues, but it also acts beneficially upon the air itself, purifying it. Air is cleansed by motion. It loses its deleterious chemical properties and rids itself of bacteria.

Living in the open lessens the danger of infection from acute respiratory disease by diluting the bacteria-laden air. The opportunity for contagion is greater on the other hand in a closed room, and at the same time the patient so living suffers from a relative lower resistance which makes him more susceptible.

Some judgment must be used in instituting open air treatment in cold weather. The dosage of open air should be regulated. No patient should be subjected to stimulation to which he cannot react; for "reaction" is the essence of treatment. If one who has lived in closed apartments is to be placed in the open in cold, wintry weather he must be prepared for it by suitable clothing, hot bottles and other devices, and should be subjected to the more stimulating conditions gradually.

The patient who reacts readily and is fully able to withstand the more rigorous weather conditions shows a greater natural resistance and should have greater resistance to the disease. Those who react poorly must be assisted so that their resistance increases.

Several improvements in the patient are due to

open air: Acting upon the sensory nerves of the skin, it soothes the patient, relieves nerve tension, promotes sleep, increases the appetite, aids digestion, increases metabolism, lowers temperature, and slows the heart.

The proof of the physical effect of open air upon the patient forces upon us a very different understanding of its action from that formerly held, and should lead to the general establishment of a safe and sane method of its employment so as to give its advantage to the weak as well as the strong.

There has long been an antagonism to night air and it is not uncommon to hear advice given to patients that they should always be in the house by sundown. This prejudice is unwarranted. Night air is as salutary as day air and particularly in the city contains fewer particles of dust and bacteria because there is less street traffic. The evil effects which have so long been ascribed to night air have not been due to it, but to what the patient did while out in the night air.

Open air, day and night, whenever practical should be furnished to the tuberculous patient; and when the open is impractical, well ventilated rooms with air in motion should be substituted.

## CHAPTER X

### REST

At the present time there is no specific remedy against tuberculosis. Tuberculin has a specific action, in that it will cause a reaction in tuberculous patients and in tuberculous tissue, but it is not a specific in the sense that quinine is a specific in malaria, or antitoxin in diphtheria. Until some remedy is found which will destroy the tubercle bacillus in the body of the patient, and thus eradicate the infection, the chief burden of cure is to increase the natural defensive powers and processes of the patient, so that he may overcome the disease.

There are many helpful measures which may be employed in building up the strength and resistance of the patient, such as open air, good food, rest, exercise, light, air and water baths, psychotherapy, tuberculin, and those for the relief of symptoms and complications; but the physician who understands the value of rest and prescribes it in proper dosage at the proper time, will be giving to his patients one of the most potent remedies at his command.

I would rather have my patients understand the importance of rest, and carry it out conscientiously

during that period when it is indicated, than any other measure commonly employed in the treatment of tuberculosis.

When tuberculosis is active, it is my opinion that any patient will increase his chances of obtaining a favorable result by the employment of rest. Later there comes a time when exercise is indicated, at which time the patient's chances of being restored to health and strength demand its employment. It is necessary that the principle which governs the use of these two valuable remedies be understood by the patient.

Energy is required for every act of life. It is necessary, if any individual would keep his body in a state of high resistance so as to be able to withstand disease, that he should provide for his body as much energy as is required by all the demands that are made upon it. When the body is in a state of health this is not difficult to do. The demands made by strenuous exercises, which call for a large energy output, are quickly met by an increased appetite, and improvement in digestion and assimilation of food, especially if the individual at the same time takes the needed amount of rest and sleep. When the body is diseased, on the other hand, particularly if the disease is a chronic one, such as tuberculosis, and accompanied by toxins, then the nervous system is injured, and the body cells, which

are presided over by it, are unable to act normally; consequently the body makes up its energy supply with difficulty. Therefore an amount of exercise which would call for an energy output which could easily be met by the individual when in a state of health, is not compensated and the patient suffers. Since the wear and tear of the body must be restored, if a normal state is to be preserved, the patient must eat large quantities of food, or he will lose weight; for when he does not supply sufficient food to make this energy, energy is derived from the breaking down of his own tissues. If the disease is very active, exercise will increase the amount of toxins thrown into the blood stream, and this will reduce the appetite and interfere with the digestion and assimilation of food and prevent the building up of strength even though sufficient quantities of food may be consumed.

This can be grasped better by understanding a few physiologic facts. Sleep is the condition in which an individual approaches the nearest to rest; but even during sleep, those functions which are essential to life continue to be carried on. So there is never a time from birth until death when our bodies are not using up and demanding a renewal of energy. Rest in a reclining position is the condition which, next to sleep, requires the least

energy, while severe exercise makes enormous demands.

The energy of the body is reckoned in heat units which are called calories. A calorie is the amount of heat necessary to raise one pound of water 4 degrees Fahrenheit.

If he will maintain his body weight, a healthy man weighing 150 pounds must consume about the following amounts of food:

| | | | | |
|---|---|---|---|---|
| At rest | 1750 - 2100 | calories | per | day |
| Light work | 2450 - 2800 | " | " | " |
| Moderate work | 2800 - 3150 | " | " | " |
| Hard work | 3150 - 4200 | " | " | " |

Exercise means the using up of energy. This must be supplied by more food. Experiments show that 20 per cent more energy is required to sit in a chair than to lie prone, 50 per cent more if the patient exercises moderately, and 100 per cent more if the patient does hard work.

The patient suffering from tuberculosis should be able to care for the wear and tear of his body and still have a surplus of energy left each day, that it may be applied to the healing of his disease. If he does not have this, he cannot expect to win his fight for health.

The desirability of rest during the stage of active tuberculosis is again emphasized by comparing the work of the circulatory and respiratory sys-

tems at rest and at work. Muscular work increases the consumption of oxygen in proportion to its intensity. At rest the lungs take in from six to eight liters of air per minute; but during work this is increased to twenty-five or thirty, and after a 100 yard dash may be increased to 150 liters. This air carries the oxygen which is demanded by the muscles. It must be carried to them by the blood; therefore, not only the work of the lungs but the circulation as well greatly increases during exercise. It has been estimated that about 1.66 liters of blood flow through the skeletal muscles per minute when the body is at rest, but when performing hard work this amount is increased more than eight fold or to over 14 liters; and while the heart discharges from three to five liters of blood per minute where the individual is at rest, heavy muscular work calls for more than twenty liters to be discharged per minute. In propelling the blood through the body the heart normally pumps seven and one-half tons of blood per day which is equivalent to raising one ton of blood one hundred and twenty-two feet. Heavy work greatly increases this.

These simple physiologic facts present an excellent reason why an individual whose lungs are seriously inflamed as they are in tuberculosis, should not be called upon to do more work than is consistent with his condition.

There are still other arguments which carry much force. Active tuberculous foci produce toxins which under ordinary circumstances slowly gain access to the blood stream, and are destroyed by the defensive processes of the body. If they are present in large numbers they exert a very deleterious influence on the nervous system, and through it on all the vital forces of the body. It can be readily believed that twenty liters of blood flowing through tuberculous lungs per minute will carry more toxins into the circulation than three or four liters. The effect of toxemia is therefore greatly increased by exercise. It shows in some such symptoms as a tired feeling, an inability to do, a lessened resistance, aching, rapid pulse, rise in temperature, loss of appetite, decreased assimilation and loss of weight.

Exercise, at times, calls for more oxygen than is supplied; so the body produces more deleterious products than are oxygenized. This leaves the tissues with an excess of acid or a deficiency of their normal alkalinity. Such conditions favor necrosis and destruction of the tissues which are affected with tuberculosis. This is one reason why the lungs break down more under exercise than under rest.

Cough is increased by exercise, and this of itself often calls upon the patient for an enormous

amount of work, which causes exhaustion, and is accompanied by an enormous increase of pulmonary ventilation and a much accelerated heart action. Cough, if severe, is equivalent to hard work.

Physical rest then calls upon the patient for a minimum of energy; it holds down pulmonary ventilation and the heart output to a minimum, and so causes the toxins to gain entrance to the blood stream slowly; permits the fullest possible oxygeneration, thus preserving the closest balance of alkalinity of the tissues; and reduces the amount of harmful coughing. As a result the patient has a minimum of toxemia, and preserves the best possible nerve equilibrium, which also means the best possible equilibrium in his body functons.

The grouchiness, fault-finding and discontent of a group of patients suffering from active tuberculosis, who are upon exercise, compared with the relative comfort and contentment of a similar group upon rest, will convince the most skeptical of the psychological as well as the physical value of rest during the active stage of the disease.

When rest is first adopted, the patient may be assured that the bed soreness which he at first experiences will last only a few days. He may be further assured that the loss of muscle tone which will follow the adoption of the rest will rapidly disappear when the proper time for exercise has come.

He may be still further assured that he can eat a full and sufficient diet when resting so that he will not suffer from loss of weight unless there be reasons other than the rest to cause it. In fact, the rest is usually accompanied by an unprecedented gain in weight. While exercise is the physiologic condition which is best suited to the needs of a healthy person, when the body is diseased as in tuberculosis, conditions are different, and it often proves harmful. Here rest is the physiologic condition which is demanded.

Few people know how to rest. Lying in bed is not necessarily resting. A person can lie in bed and fret and worry, engage in animated conversation or discussion, or study, and use as much energy as is required for moderate work.

Rest, as suggested for the treatment of tuberculosis, implies not only reclining on a bed, but physical and mental repose. It means rest of the muscles, relaxation of the nerves, and mental composure.

## CHAPTER XI

## EXERCISE

While rest is probably the most important measure that can be applied in the treatment of active, clinical tuberculosis, exercise is absolutely necessary to produce a strong physical body after activity has ceased.

Let me repeat, until a specific remedy is discovered, the chief purpose of treatment of tuberculosis will be to build up the patient's own fighting force. This means the training of the patient in such a manner that he suits his body activities to the demands made upon him by the normal expenditure of energy and the abnormal demands made by the disease.

All things else being equal, an individual should be most resistant when his physical force is greatest, and his nervous and psychical systems most stable. It should be the aim of therapy to have every tuberculous patient maintain the greatest degree of nerve control and physical vigor that is consistent with his disease. When the disease is active, rest is necessary to nerve composure, because exercise increases toxemia, and this injures the nervous

system as well as the body cells generally. Even physical vigor, under circumstances in which exercise increases toxemia, is conserved and improved by rest.

When the patient is suffering from active tuberculosis, exercise by increasing his toxemia tends to decrease his appetite, and to impair his digestion, and to interfere with the assimilation of food as mentioned in the previous chapter; but when his disease becomes quiescent, then exercise, by calling for more units of energy, sends more blood to the heart muscle, the skeletal muscles and the brain and improves the general vigor of the patient. This blood, with its extra oxygen would be of no value alone. Substances to be oxygenized must be furnished. These are furnished in the food eaten; consequently exercise calls for, and at this time produces, an increased appetite and at the same time improves the digestion.

When a patient has active clinical tuberculosis, if the toxemia is at all marked, nutrition is interfered with and this affects all the tissues in the body. The muscles both of the skeleton and the heart lose tone, and become easily fatigued. The muscular system of a patient who has been treated for active clinical tuberculosis, then, is flabby and unable to perform work efficiently. These muscles must be reeducated before they are able to work

normally. Few people fully realize the necessity of this reeducation after the period of prolonged rest. I make it a rule to keep tuberculous patients at rest as long as I think the disease is sufficiently active to produce toxic symptoms on exertion, and as long as I think the extra demands made upon the patient's energy by exercise will interfere with the healing process, or increase the destructive process and favor spreading of the infection.

Oftentimes this period is a long one and the muscles become very soft and flabby. It is necessary to take this into consideration when the time of transition from rest to exercise comes. A patient who has had little toxemia can increase his exercise much faster than one who has had much; and the physician must use as careful judgment in prescribing exercise as in prescribing any other remedy. No doubt, overdoing has caused more deaths in tuberculosis than any one other procedure.

The patient, when first put upon exercise, often wonders why he cannot go faster. He feels well and notices no evil effect from the small amount of exercise taken. "If a little is good, more is better." This policy, if allowed to prevail, often proves the undoing of the patient and is the beginning of defeat. Patience and care at this time is to be used, for it is usually one of the most critical

periods in the course of treatment. Overexertion may be the cause of renewed activity and produce a state of discouragement from which the patient finds it hard to extricate himself.

There are numerous conditions which may discourage the patient when he begins to exercise. These he should know. He should also have some understanding of their significance.

As a result of exercise, respiratory effort normally increases, the heart beats more rapidly, and throws out more blood at each contraction; and the arterial tension increases. The degree to which these changes occur varies according to the degree of training of the individual. The tuberculous patient with toxemia or the one who has been on rest for a long time reacts like the untrained. The heart beats much faster in the untrained than in the trained. The same is true of respiration when he is put on exercise. And while a trained person's pulse and respiration will soon reach its normal rate after moderate exertion is ended, that of the untrained returns to normal more slowly.

Increased muscular work is followed by increased heat production; and it is usual for the temperature to be elevated during exercise. In the tuberculous, this may not be dissipated readily, hence a rise may continue after the exertion ends. In the healthy, normal is soon attained. If a few

tenths of a degree should remain in the tuberculous, it does not have any serious meaning, and should be disregarded. In fact, the same has been noted at times in the healthy, and has been explained as being due to a continuation of a heightened metabolism after the exertion has come to an end.

The question of fatigue is a very important one in connection with exercise. The rule that a tuberculous patient should never tire is a good one to follow.

Fatigue is due to the action of poisonous substances. From food eaten, fuel is stored in the muscles in the form of a sugar which is known as glycogen. This is a reserve substance which is always drawn upon when work is performed, and if the work continues after this supply is exhausted, then the body tissues are converted into glycogen and used. Glycogen combines with the oxygen of the blood and produces heat and energy which contracts the muscles. At the same time carbon dioxide and other acid wastes are formed. If these acid waste products are not carried off, fatigue results. If the fatigue is slight, during rest the waste products will be carried off and the tissues restored to a normal status.

By training, fatigue production can be avoided or be made harmless. This probably comes about

in two ways: first, by increasing the oxygen supply to the tissues through increased pulmonary ventilation and a more efficient circulation of the blood, thus giving a better tone to the tissues themselves; and second, by so gradually accustoming the individual to increased amounts of the waste products that his tolerance for them is increased.

In training, it is best to begin with a small amount of work and increase the amount gradually. The muscles including the heart will increase in tone and efficiency under the gradually increasing demands, and the harmful waste products will gradually lessen, and so fatigue will be avoided.

Another important factor in avoiding fatigue, and in producing efficient work is stable nervous and psychical systems. Not only is work done more easily by those who have stable nervous and psychical systems, but it is also done better.

These principles, when applied to a person who has been suffering from tuberculosis, a disease which produces the toxins which cause fatigue of the muscular and instability of the nervous and psychical systems, even when the patient is at rest, give a basis for great care in the institution of exercise when the proper time has come.

The first exercise should be such as will call for so slight an increase in energy production that it can be carried on without fatigue; and this should

be increased daily. The heart and other muscles under this plan will respond by increasing in tone, in size and in strength. The increased energy requirement will be met by increased appetite, leading to increased food consumption and improved metabolism. As a result there will be a quickening of physiologic activity; and the body cells which heretofore were able to function best only when the organism was at rest, will now function under the natural stimulation of exercise, and this will result in further increased resistance on the part of the body cells and further resistance to the disease.

No patient should ever be dismissed from treatment until his physical strength and nervous and psychical equilibrium have been restored to the highest point consistent with his condition. In some, this will mean an ability to walk one mile, in others ten. When a patient can walk ten miles day after day without fatigue, he may usually feel confident that his disease is clinically well arrested, and that he can begin productive work without danger, provided he continues to follow out hygienic precautions.

## CHAPTER XII

## FOOD

Food is eaten for the purpose of rebuilding the body cells, and supplying energy for work of all descriptions performed by them.

Food is fuel which, when digested, is carried to the body cells along with oxygen, where it is burned up, liberating energy to make the animal machine go. The blood stream carries different substances which are picked up by the various tissues and transformed into living cells. It is interesting to think how kidney cells take particles from the blood stream which will make new kidney cells; lungs substances which will make lung cells; stomach those which will make stomach; brain those which will make brain; and so on, each choosing and transforming without error.

There is a minimum demand for energy made by the body when at rest. This is called the basal metabolic requirement. This requirement is met by the ingestion of just sufficient food to restore the wear and tear of the organs when the body is at rest, and to supply the fuel for the performance of their necessary activities, leaving no residue to

be stored up in the body, or for the performance of extra work.

The foods which make up the dietary of man belong to three classes; proteins, fats, and carbohydrates. There is also supplied to the organism along with the food, water and salts which are necessary to life. These substances are found unequally distributed in plants and flesh which are used for food. These foods are of different values to the organism. Protein is normally the tissue builder, carbohydrates the energy producers, and fats are naturally stored as fats. When one of these types of food is absent from the dietary, however, the organism is able to utilize the others by passing them through chemical changes. Thus protein can be utilized to make muscular energy although this is the natural province of the carbohydrates.

The body, when in a state of health, always has a reserve of fats and carbohydrates stored in the tissues, the fats as fat and the carbohydrates as glycogen. Glycogen is stored in the muscles and liver. When muscular effort is made, the energy for such effort comes first from the oxygen of the blood combining chemically with the glycogen in the muscles, that is, by oxydizing or burning it up. If the muscular effort continues over a long time,

all the glycogen in the muscles may be used up. That which is in the liver is then called for. Then if the intake of carbohydrates is not sufficient to meet the demand, the fats deposited in the body or those ingested are utilized. Finally if the energy cannot be supplied from any of these sources, the protein of the tissues is broken down, converted by chemical processes into glycogen, and then used the same as though it were originally made from the carbohydrates.

Not all of the food eaten, by any means, is utilized in energy production. It has been estimated that as much as 50 per cent of some foods is utilized in its mastication and digestion. The horse utilizes 48 per cent of the energy derived from hay in its mastication and digestion. The chemical reactions which are produced during the digestion and assimilation of foods utilize a caloric value equal to 2½ per cent for fats, 9 per cent for starches, and 17 per cent for proteins (Hill and Flack). This explains why proteins should be consumed sparingly in warm weather.

The quantity of food required for preservation of health depends on many conditions. Man requires more food than woman, and the growing child more than the adult. The slender man requires relatively more food than the fat man.

Much of the food eaten is required to keep up the heat of the body. Heat is given off mainly through the skin. The body surface is relatively greater in small and thin persons than in large ones, consequently relatively more heat is lost in the spare, and they are required to eat more food than those who are large.

Many dietaries have been established which are considered as standard. They vary somewhat, yet they are not widely divergent. Voit gives for a working man performing eight or nine hours of labor: protein 118 grams, fat 50 grams, and carbohydrates 500 grams. This would make a total of 3055 calories or heat units a day. Other authorities allow a larger amount of protein, while still others cut it down.

It is impossible to estimate a dietary which will be efficient under all circumstances, because some foods are much more valuable than others of the same class, and some are more easily digested and assimilated. Again the type of food demanded varies much with the condition of the consumer, and with the character of other foods taken.

Diet is not only a matter of digesting an amount of protein, fats and starches sufficient to care for the needs of growth, repair and energy demands; it also requires an adequate supply of water, salts

and certain substances which have recently been described under the name of vitamines.

It has been shown by careful feeding experiments that such substances as wheat, corn, rice, rolled oats, rye, barley and peas are not capable of themselves of properly nourishing animals. Animals fed upon them will not thrive, but if leaves of plants or milk is added, then nutrition and growth improve. Analysis shows that these various seeds are wanting in three important mineral elements, calcium, sodium and chlorine, and that they are further poor in their content of certain undefined elements found in butter fat and the leaves of plants. After careful study of this problem it was found that there are at least two substances, one, soluble in certain fats, and the other, soluble in alcohol and water, which are essential to growth. The former is found in butter fat, egg yolk, fats of such organs as the kidney and the liver, but not in fats of vegetable origin. The latter is found in the leaves of plants and trees and in the skin of such articles of food as the apple and potato. McCollum and Kennedy suggested that these two substances be called "fat-soluble A" and "water-soluble B." Just what the substances are has not yet been determined for they have not been isolated.

These new discoveries enable us to take a new view of food and dietaries. We have learned that

milk and eggs have a value far greater than that which depends upon their content in protein, carbohydrates and fats. We have also learned that the leaves of plants, lettuce, spinach, the various leaves used as greens, cabbage, onions, the skin of the potato and apple all contain the product called "water-soluble B," which is an essential element in the dietary.

Fortunately the human family has naturally chosen foodstuffs which contain both of these substances in sufficient amounts to guarantee proper nutrition and growth, and it is only under exceptional circumstances that they are deprived of them. During the World War some of the fighting nations suffered particularly from the want of dairy products and eggs which are the main source of supply of "fat-soluble A."

Seeds, tubers, roots and meats alone or in combination will not produce proper nourishment, but by the addition of milk, eggs and the leaves of plants their deficiencies are made up. This gives an added food value to the leafy vegetables which, on account of their low content in protein and carbohydrates, have been wrongly classed as foods of poor nutritional value. It also shows the importance of milk and eggs. They must continue to be made an important part of the diet of the people.

People as a rule eat a varied diet, but one in which no attempt is made to have it properly balanced. They eat what they like, cooked in the way they like it; or, what they can afford to have. Fortunately the necessary fats, carbohydrates and protein are so distributed and so combined in various foodstuffs that the needs of the body are usually fairly well met. The "fat-soluble A" and "water-soluble B" substances, together with the necessary salts, are also usually present in foods commonly found in the dietary.

People should have some idea, however, of the sources of each of the three groups of food, that they may combine them intelligently since it is desirable that a diet, aside from salts and vitamines, should be made up of probably a little more than 1/5 protein, a little less than 1/5 fat and 3/5 carbohydrates. This can only be approached by knowing, at least roughly, the proportion of each of these found in the principal articles of diet.

Foods belonging to the three classes, proteids, fats, and carbohydrates, vary in their heat-producing properties or in their caloric values. Fat has the highest caloric value. One gram of fat produces 9.3 calories, while the same quantity of protein or carbohydrate food will produce 4.1 calories.

Moritz shows that the following number of cal-

ories per kilo. of body weight should be furnished in the daily dietary of an adult of average nutrition and size:

| | *Calories* |
|---|---|
| Resting in bed | 30 - 34 |
| Quiet out of bed | 34 - 40 |
| Moderate work | 40 - 45 |
| Hard work | 45 - 60 |

If we apply this to an individual weighing 60 kilos or 130 pounds, he would require:

| | *Calories* |
|---|---|
| Resting in bed | 1800 - 2000 |
| Quiet out of bed | 2000 - 2400 |
| Moderate work | 2400 - 2700 |
| Hard work | 2700 - 3600 |

In order to furnish the necessary calories it would require, if the patient was eating one type of food exclusively, the following amounts per day:

| | *Fats* | *Proteid and Carbohydrates* |
|---|---|---|
| Resting in bed | 190 - 200 grams | 440 - 500 grams |
| Quiet out of bed | 220 - 250 " | 500 - 590 " |
| Moderate Work | 250 - 290 " | 590 - 660 " |
| Hard work | 290 - 390 " | 660 - 880 " |

Tuberculous patients who are in the open air can take care of a fairly liberal diet even though they are at rest. A diet suited to the man in moderate work containing from 2,400 to 2,700 calories is a

fairly satisfactory diet for the tuberculous patient of the above average weight of 130 pounds. This can be increased at times temporarily if the patient is not gaining satisfactorily and can be reduced if the patient will maintain himself satisfactorily on less. When patients are not gaining satisfactorily foods containing "fat-soluble A," and "water-soluble B," should be added as well as the fats and carbohydrates.

The following tables show approximately the amounts of protein, fat and carbohydrate in the foods most commonly used and will aid one in forming an idea of the energy producing values of different common articles of diet:

FOOD VALUES OF COMMON MEAT AND MILK PRODUCTS

| | PROTEIN PER CENT | FAT PER CENT |
|---|---|---|
| Bacon | 10 | 60 |
| Beef | 30 - 50 | 15 - 30 |
| Cheese | 20 - 35 | 20 - 35 |
| Chicken | 15 | 1 |
| Clams | 1 | 3 |
| Crabs | 7 | 1 |
| Eggs | 13 | 9 |
| Fish | 10 | 1 - 10 |
| Goose | 10 | 33 |
| Ham | 20 | 30 |
| Lamb | 15 - 18 | 15 - 25 |
| Lobster | 5 | 1 |

| | PROTEIN PER CENT | FAT PER CENT | CARB. PER CENT |
|---|---|---|---|
| Milk | 3 | 4 | 5 |
| Mutton | 12 - 18 | 20 - 35 | |
| Oysters | 7 | 2 | |
| Pork | 10 - 18 | 20 - 35 | |
| Sausage | 12 - 20 | 20 - 40 | |
| Turkey | 15 | 18 | |
| Veal | 15 - 20 | 5 - 10 | |

FOOD VALUES OF COMMONLY USED FRUITS

| | PROTEIN PER CENT | CARBOHYDRATES PER CENT | CELLULOSE PER CENT |
|---|---|---|---|
| Apples | .5 | 12 | 2.5 |
| Apricots | 1 | 12 | |
| Bananas | 1.5 | 23 | trace |
| Blackberries | 1 | 2 | 5 |
| Cherries | 1 | 10 | 4 |
| Cranberries | .5 | 4 | 6 |
| Figs | 5.5 | 60 | 7 |
| Grapes | 1 | 15 | 2.5 |
| Gooseberries | .5 | 9 | 3 |
| Melons | .5 | 7 | 1 |
| Oranges | .1 | 9 | 1.5 |
| Pineapple | .5 | 10 | |
| Pears | 1.5 | 11 | 3 |
| Peaches | .5 | 6 | 3.5 |
| Plums | 1 | 15 | 4 |
| Prunes | 2.5 | 66 | 1.5 |
| Raisins | 2.5 | 75 | |
| Raspberries | 1 | 5 | 7 |
| Strawberries | 1 | 6 | 2 |

FOOD VALUE OF COMMONLY USED CEREALS

| | PROTEIN PER CENT | FAT PER CENT | CARBOHYDRATES PER CENT | CELLULOSE PER CENT |
|---|---|---|---|---|
| Barley Meal | 10 | 2 | 70 | 1.8 |
| Buckwheat | 7 | 1 | 75 | .6 |
| Cornmeal | 8 | 5 | 70 | 1.5 |
| Oatmeal | 14 | 7 | 65 | 3.5 |
| Rye Flour (coarse) | 15 | 2 | 65 | 2 |
| Rye Flour (fine) | 7 | 1 | 80 | |
| Wheat Flour | 10 | 1 | 75 | .7 |

PERCENTAGE OF CARBOHYDRATES IN THE COMMONLY USED VEGETABLES

| 5% OR LESS | 10% | 15% | 20% |
|---|---|---|---|
| Lettuce | Onions | Green peas | Potatoes |
| Spinach | Squash | Parsnips | Baked beans |
| String beans | Turnips | Lima beans | Green corn |
| Celery | Carrots | Apples | Boiled rice |
| Asparagus | Beets | Pears | Macaroni |
| Brussels sprouts | Mushrooms | Apricots | Plums |
| | Lemons | Cherries | Bananas |
| Ripe olives | Oranges | Currants | Almonds |
| Grape fruit | Cranberries | Raspberries | |
| Cauliflower | Blackberries | Pecans | |
| Tomatoes | Strawberries | Filberts | |
| Rhubarb | Peaches | Walnuts | |
| Egg plant | Pineapples | | |
| Clams | Watermelon | | |
| | Muskmelon | | |

Inasmuch as fat is quite an important article of diet in the food of the tuberculous, the following

table representing the percentages of fats in articles of food which are commonly used, is of value:

FOOD VALUE OF COMMONLY USED FATS

| | |
|---|---|
| Bacon | 65% |
| Beef | 15 - 30% |
| Butter | 85% |
| Nuts | 30% |
| Oatmeal | 7.1% |
| Olives (ripe) | 25% |
| Olives (green) | 13% |
| Pork | 80% |

The question of the amount of food to be eaten by a tuberculous patient requires discussion. Formerly, and occasionally even today, a diagnosis of tuberculosis is made synonymous with overeating. As soon as a diagnosis is made, the patient either of his own accord or through advice, begins to eat heartily at his meals, and adds milk and eggs, both at meal time and between meals. This is not only useless but often harmful. The patient with tuberculosis, the same as the healthy individual, should maintain his weight and supply his energy requirements on the least amount of food possible. From what we have learned of milk and eggs containing the "fat-soluble A" substance, we can see that they are a valuable addition to the diet, but when they are added, the patient should eat less of other foods so that his intake is not more than necessary for

the requirements of the body. Overeating causes putrefaction to take place in the bowels and interferes with normal physiologic function.

When constipation is present, the average patient will prescribe fruits for himself. It has been my observation in Southern California where fruits are plentiful the year round, that these are frequently an excitant of constipation. In many of the tuberculous there is an irritable condition of the bowel, and by the ingestion of fruits in large amounts, the formation of gas is favored, which becomes an increasing irritant which makes the constipation worse. Constipation can often be relieved by a suitable diet, provided the patient will persist in it sufficiently long. It rarely yields quickly, however, and must be combated for a long time.

## CHAPTER XIII

## BATHS: WATER, SUN, AND AIR

That the body activities may be influenced through the skin is well known, but the extent to which this is possible is hardly appreciated. The skin has several functions. It is an organ of absorption and excretion. It gives shape and beauty to the body and provides a covering for the important organs lying within; and being well supplied with sensory nerves it protects them from harm. The nerves in the skin are able to perceive and distinguish different forms of stimuli with which it comes in contact and to distinguish between those which are harmless and those which are harmful. It distinguishes touch, pain, heat, and cold. The skin, further, has the very important function of regulating the heat of the body. Eighty per cent of the heat of the body is thrown off through the skin. This function is performed through its blood supply and its sweat glands. When a person's body is cold because of heat loss, the superficial blood vessels are constricted and heat retained until the proper temperature is restored. When too much heat is produced, on the other hand, the

superficial blood vessels dilate and sweat is secreted which carries off heat during its evaporation.

The function of viscera as well as that of the skeletal structures is influenced by stimuli which act upon the skin; and, on the other hand, the superficial blood vessels, the sweat glands, the pilomotor muscles, and the skin cells themselves are all influenced by stimuli which arise within the body.

It will be recalled, as discussed in other chapters, that the effect of open air, weather changes, and climate are expressed through the skin. The different degrees of heat and cold, dryness and humidity and the various degrees of force expressed by the air movement all affect the fine network of nerves found in the skin differently. Therefore it is evident that the reactivity of the skin should be kept as perfect as possible.

The skin may be influenced by many things; but there are three big factors found in nature which acting through the skin may be utilized to the great advantage of the patient—water, sunshine, and air. Water baths, sun baths and air baths may all be used in the treatment of the tuberculous patient. We must not expect any of them, however, to have any specific effect upon tuberculosis. They produce the same beneficial effect upon the nontuberculous as upon the tuberculous.

When properly used they act as tonic measures which may increase the patient's reacting powers and raise his resistance. They all possess the power, too, of hardening the patient and increasing his ability to adjust himself to outside influences such as changes of weather. In this way he becomes more resistant to colds and other infections.

## Water Baths

Water, when applied to the skin in different ways, produces different effects. These effects depend upon the temperature of the water, the vigor of application, the length of application, and the condition of the patient when the water is applied. Many people think that "a bath is a bath," and that no matter how water is applied, the effect is the same. But such is not the case. Cold water is stimulating. Hot water is ennervating or depressing, and tepid water exerts a neutral effect. Each of these can be varied in their action by different methods of application.

There are some varieties of baths that may be used with advantage in treating tuberculosis and some that are harmful. The cold bath when applied correctly has a stimulating effect upon the patient. It acts as a tonic, increases metabolism and stimulates all of the important functions of the

body. Under its influence we often see the appetite increase, digestion improve, nervousness disappear and sleep return.

It is not wise to give a cold bath to all patients; and some forms of baths are particularly unsuited. There are three methods of applying cold water which are commonly used, the cold sponge, the cold plunge and the cold shower. The cold sponge is the safest for tuberculous patients, because a small portion of the body only is wet at one time, thus making fewer demands upon the reacting powers of the patient. If the degree of cold is suited carefully to the patient, no harm but only good effects will result. This cannot be said of the cold plunge or the cold shower. Here the entire body is wet at one time and this calls for strong reacting power on the part of the patient.

The cold sponge bath may be taken by all vigorous patients who are free from active symptoms. I personally do not like the plunge or shower for those who have active tuberculosis and they are certainly taboo when bacillus-bearing secretions are in the air passages, for the deep breath which follows the application of the water favors aspirating the bacilli into new areas and setting up new infection. Baths, of all kinds, should be taken by the tuberculous patient only on the order of a physician.

The value of the bath lies in the reaction. The patient should have the degree of cold suited to his individual reacting power. This may be gradually improved even though it may be very low at the beginning. The vigorous rub, after the application of the cold water, is a very important part of the bath. Those who are not able to rub themselves well should not take the bath alone.

Hot baths should not be used unless prescribed for some temporary purpose by the physician. Tepid baths should be taken sufficiently often to keep the skin clean.

When baths are properly used they keep the skin in a state of good nutrition and the sensory nerves contained therein in a state of normal reactivity; and the individual is therefore better able to eliminate deleterious products from the body, and to govern heat dissipation.

### Sun Baths

Sun baths are thought by some to have specific influence in the cure of tuberculosis, but this is very doubtful. It seems far more natural that they exert their influence upon the organisms through the skin in the same manner as water baths. Rollier of Leysin, Switzerland, has carried the use of sun treatment (heliotherapy) farther than any other observer. He accustoms his patients to the sun

rays very gradually, but finally gets them so that they expose practically the entire body for several hours a day. This is even carried on in winter when snow is on the ground. Even children play in the snow, nude, except for a pair of trunks.

The value of this treatment is supposed to be due especially to the effects of the short or chemical rays of the spectrum, the ultra violet being the strongest. These rays are found in greatest proportion in the mountains, therefore the mountains are especially suited to this line of treatment. But it can be used anywhere with advantage. I have used it in Southern California for about twenty years. The patient must be gradually accustomed to the sun and must protect his head from the direct rays. There are times when it should not be used, so it should be taken only under the guidance of a physician.

### Air Baths

Some patients cannot advantageously be given the cold baths or the sun baths, but practically all can take air baths. These exert their influence in the same way as the more exacting baths but make fewer demands upon the patient. They are applicable to those who have fever, as well as to those who have not. The patient may gradually expose himself to the air, first a small portion of the body

and only for a few minutes. The amount of surface exposed and the length of exposure are gradually increased until the entire body is exposed for an hour or so a day. By this means the nutrition of the skin may be improved and the general reactivity of the patient, increased at a time when more vigorous methods are unsuited.

## CHAPTER XIV

## CLIMATE

There is no specific climate for the treatment of tuberculosis. It can be treated successfully anywhere. This is very fortunate, because with a disease so prevalent as tuberculosis, if some special climatic conditions were necessary to its healing, many would be deprived of an opportunity to get well.

These statements do not mean that all climates are equally favorable for the treatment of this disease; but mean that when we count up all the important measures which may be employed advantageously in the treatment of this disease that the element of climate makes up so small a percentage of the whole that it can be dispensed with, without ruining the patient's chances of cure. This is evident from the fact that while we have no one thing that will cure tuberculosis we have many measures, each of which may add from five to twenty per cent to the patient's chances of cure when properly employed. Any one measure can be withdrawn without seriously handicapping the patient's chances of cure provided that the others are used more perseveringly.

"The average state of any place with regard to its temperature, the direction and strength of the wind produced by differences of pressure, and the amount of moisture held as vapor or precipitated, may now be defined as the *climate;* and the state from time to time, within the limits of deviation from the average, as the *weather* at that place." (Dickson.)

We must admit that civilizations have depended much upon these factors. "Today a certain peculiar type of climate prevails wherever civilization is high. In the past the same type seems to have prevailed wherever a great civilization arose. Therefore such a climate seems to be a necessary condition of great progress." (Huntington.)

We are justified in assuming that wherever a great civilization arises and endures that the climatic conditions of that place are fairly favorable to human activity, which means fairly favorable to the activities of the human body. It is in the people of these more favorable climates that we are particularly interested in our discussion. Huntington in his splendid study on "*Civilization and Climate,*" after recording and correlating the various factors which influence the efficiency of workers in the eastern portions of the United States, calls attention to the fact that barometric changes have little influence, humidity more but

temperature most. He shows that people do not work most efficiently where temperatures remain constant, or where the changes are too great; but, that the most favorable conditions are where changes are moderate and the air is cooled at frequent intervals.

These are the conditions which particularly effect working efficiency. There is no place that is perfect, but one can readily see that the greater portion of our country has, at least during some seasons of the year, climatic conditions which are fairly favorable to the efficient working of the human machine. Since the essential factor in climate is the stimulus to the working forces of the body as a machine it is fortunate that this can be had in widely distributed areas.

While tuberculosis may be treated in any climate, there are certain ones which possess a special reputation for their favorable influence upon the tuberculous patient. For some of these the reputation is well deserved; but when one reads the confusing statements of partisans of different climates, he is lead to believe that the subject requires calm, dispassioned discussion rather than partisan treatment. Opinion is based on knowledge and experience. From the character of the discussions of climate which have appeared in the tuberculosis literature one is forced to the conclusion that many

of the disputants have been short on both of these essentials.

The first observations on which the modern climatic treatment of tuberculosis is based were erroneously interpreted. Jourdanet, a French physician, noticed the infrequency of tuberculosis in the altitudes of Mexico as compared with the lowlands, and Sir Archibald Smith noted the same in the Andes of Peru. They observed that in the small hamlets at an altitude of 7,500 and 8,000 feet there was almost no tuberculosis, while in the lowlands it was common. These observers, however, failed to take into consideration the sparseness of population in the altitudes as compared with the lowlands, and drew the conclusion that there was an immune zone at an altitude of about 5,000 feet or 6,000 feet beyond which tuberculosis could not thrive. They and their followers concluded further that if tuberculosis did not develop at this altitude conditions must there exist which would aid in the cure.

Every factor of weather and climate, and every physiologic change found in the body at altitudes as contrasted with lowlands, has since been investigated and employed by the adherents of high altitude climates to show that they are superior to lowland climates for the treatment of tuberculosis.

It was later found that there was little tubercu-

losis in the lowlands of the great Southwestern desert, and in the Steppes of Russia and in the Sahara; even in those parts which were below the sea level. It was also found that patients suffering from tuberculosis regained health in all of these places; so, these places too were added to the favorable climates, although they did not possess a high elevation. It was then found that the Riviera in Southern Europe, Southern California, and many of the islands of the sea were also furnishing favorable conditions for cure. And, while these special climates were being studied and praised, each by its particular adherents, patients went on getting well in all climates and all countries. This has finally established the important fact that wherever the disease exists cures take place; and no matter how favorable the climate, patients who neglect their disease die of it.

Tuberculosis can heal, then, in any climate; nevertheless, to be fair and honest, it must be admitted that there are climates in which there are certain factors that, while not essential, yet add something to the patient's chance of cure. The stimulation of the metabolic processes which occurs at altitudes such as found in Colorado, New Mexico and elevated portions of Arizona and California in America, and the Alps in Europe, is often a decided aid to recovery. The dryness of the air and the greater

penetration of the sun's rays are also factors which exert favorable influences. Similar favorable factors also exist in the Southwestern Desert, in the coast regions of California, and in the Riviera, which aid and at the same time make the getting well of tuberculosis pleasant. These regions possess a dry or moderately dry air; much sunshine, some a maximum amount; the tonic influence of cool nights (found particularly in the foothills and near the coast); in many places the advantage of beautiful surroundings; and conditions under which the patient is invited to be out of doors the year through. These are important physiologic and psychologic factors. Each favorable factor while not essential to cure adds its percentage and makes the cure easier and more attractive.

Unfortunately the beauties and curative influences which are present in such climates as are found in the mountains, deserts, favorable foothill regions of Southern California and the Riviera are not available to all. Only those who are financially able to make a change and maintain themselves can avail themselves of the benefits of climatic change.

No matter how favorable the climate in which a patient is permitted to pursue his cure, he still needs all the help that the carefully trained physician can give; for, after all, the guidance and direction of one who understands tuberculosis and

the tuberculous patient is the greatest factor in overcoming this disease. The same measures must be applied in the favorable climates as in the unfavorable. After twenty-five years of practice in Southern California, I wish again to emphasize the sentiment which I expressed many years ago, "I would rather be treated intelligently in the worst climate than run wild in the best."

## CHAPTER XV

## TUBERCULIN

What should be the patient's attitude toward the use of tuberculin? It should be an acquiescence in the opinion of the physician who guides the case. If he has faith in its use and knows how to administer it and desires to do so; then the patient should let him do so. If he does not have faith in it, and has not had experience in its use, he should not be asked to use it.

Tuberculin when given properly is of value, and entirely harmless. When given improperly it may do harm. The reactions that were produced when it was first put on trial are no longer obtained. The benefit to be derived from it can be had without the least discomfort to the patient. I, personally, do not see an average of two temperature reactions amounting to 99.5° in a month; and yet I use it extensively.

Artificially used tuberculin is not indispensable to cure, yet it will add to the patient's chance of cure. I think it will add at least twenty per cent and in some cases much more than this.

No patient can have tuberculosis without having

products similar to tuberculin in his system. As the bacilli grow they throw off substances which are similar to, if not identical with, the substances which are given off in the culture broth from which Koch's Old Tuberculin is made. And as the body cells destroy bacilli, their bodies go into solution and set free substances which are very similar to the tuberculins which are made from the bodies of the bacilli, such as Koch's T. R. and B. E.

These products of the tubercle bacillus are necessary for the cure of tuberculosis. Without their stimulating influence on the body cells the patient would never be able to set up more than a minimum of resistance and would undoubtedly succumb to acute tuberculosis. But when the bacilli grow, likewise when they go into solution, the substances derived from their bodies stimulate the body cells and these in turn produce antibodies which attack and destroy more bacilli. As more bacillus substance is thrown into the blood stream the power of the cells to produce antibodies is increased, and in this way the patient's resistance is built up.

The products from tubercle bacilli aid in another way, too. They cause the blood vessels around the tubercles to be filled with blood and this favors healing. This is called a focal reaction.

Now if we are asked why we should employ tuberculin made artificially when the patient al-

ready has it in his system, we are confronted by a question to which it is difficult to give a satisfactory answer. The best and most convincing answer to me has been the results obtained. I have seen tuberculosis of the larynx and tongue, where I could see the progress with my own eyes, yield when tuberculin was added to the treatment, although the same patients had been under the usual open air regime without any benefit for months before. I also see the same thing in pulmonary cases. This is not an isolated but a regular experience.

It is possible that the body cells get accustomed to the body's own tuberculin and so are no longer stimulated by it after a high grade of immunity has been established. Then, the addition of a new product made from a different culture of bacilli grown on a different culture medium may once more stimulate the body cells both to the production of new antibodies and to the production anew of focal reactions.

Tuberculin is not a poison that the patient need fear if the physician who treats the case knows how to use it. Patients get all kinds of ideas of what it will do, some of which are very peculiar. It is accused of all kinds of misdemeanors. The patient is prone to blame the measure which is most pronounced in his own mind for all the adverse symptoms that appear during treatment. He may

overdo, and cause a rise of temperature, but if a dose of tuberculin was administered he usually suspects it and spots it as the culprit. I have seen it blamed for such rises in temperature as those caused by digestive disturbances which come from indiscretions in eating; for headaches which were due to stomach disorders; for blood spitting which resulted from weather changes; for increased cough and expectoration which was due to activity in the disease; in fact, for nearly every symptom and nearly every complication which accompanies the disease.

The physician who uses tuberculin most understand the remedy, what it will do and what it will not do; he must know tuberculosis and the course that it runs when tuberculin is not given; he must know the patient and the manner of his cooperation and also understand his mental attitude toward treatment in general and tuberculin in particular; then he will be able to give his tuberculin knowingly and be able to interpret the effect that is being produced by the remedy.

## CHAPTER XVI

## COUGH

Cough is the symptom of tuberculosis which is most constantly present from the time the pulmonary tissue begins to break until the process is arrested. It appears whenever the inflammation in the lung is sufficiently extensive to irritate the nerve endings and excite the reflex. This occurs often before the destruction of tissue takes place; but many cases of early clinically active tuberculosis are entirely free from cough. As our diagnostic skill increases, this number will become increasingly greater. Strange as it may seem there are patients who die of tuberculosis without ever having a marked cough, and a few have been reported who did not cough at all.

The irritation which starts the cough, as far as the patient knows, is in the larynx. This is where the sensation which causes him to cough is felt. The real cause may be far from that point, down at the base of the lung, anywhere throughout the bronchi, or in the pleura. The fact that the sensation is in the throat causes the patient to believe that the disease is in the throat. The nerve which supplies the larynx with sensation is a branch of

the same nerve that supplies the lung and pleura, and is in reflex connection with it in such a way that irritation in the lung and pleura causes sensation in the larynx. It is important for those with early tuberculosis to know this.

Cough may also be caused by inflammation in organs other than the lung and pleura, such as the larynx itself, the pharynx, the tonsils, the ear, and the nose or sinuses.

Patients are far more willing to believe that the trouble is in some other organ than in the lungs themselves. For this reason the cough of early tuberculosis often directs the patient to the throat specialist and in too many instances time is wasted and the patient's resistance is lowered by operation on the nasal passages, uvula, and tonsils, in the hope that this will relieve the cough. While these operations might be very advantageous to the patient were he in condition to stand them, we often see them start the patient downward and jeopardize his chances of recovery. It is not best for any patient with early active tuberculosis to undergo an operation which is likely to lower his resistance, unless it is considered by his physician to be extremely important; for this is the time when all possible resistance is needed for fighting the serious disease which threatens the patient's life.

Cough in tuberculosis may be caused either by

the inflammatory process in the lung or the secretion in the bronchi. Both of these, irritate nerve endings which reflexly cause a sensation in the larynx which forces the patient to cough.

Cough is utilized by the patient for the purpose of expelling secretion from the air passages. Often, however, he coughs to no purpose, and with the unnecessary expenditure of much energy. He should not yield to every irritation. He should not cough a single time that he can avoid. If he waits until the secretion comes up near or into the throat he can expel it with comparative ease. If, on the other hand, he yields to every sensation, he will have to cough harder and longer in order to gain his end. The mucous membrane of the bronchi are lined with ciliated cells which wave or sweep everything toward the throat; so if one can be patient and resist the impulse to cough for a time, these will work the secretion upward for him.

A severe cough is detrimental to the patient. It is an explosive action which injures the delicate newly formed scar tissue, and if it is severe, it exhausts the patient. The effect is the same as so much work. We often see the temperature go up several degrees, the pulse become rapid and the patient become exhausted after a prolonged coughing spell.

The use of sedatives to check cough is to be

avoided whenever and wherever possible. The most efficient cough tablets, that is the ones that will check a severe cough, nearly always contain opium in some form, so they should be avoided as much as possible. The patient must resist the tendency to cough at times with all the force that he can muster. Just as he should "will" to get well, and "will" to sleep in case he is suffering from insomnia, so he should "will" not to cough. Cough also favors more coughing. It stimulates the mucous glands of both upper and lower air passages and causes a free flow of secretion which of itself stimulates further tendency to cough.

The amount of cough as well as the amount of secretion increases and diminishes intermittently throughout the disease. This change in amount is due partly to the changes in the activity and quiescence of the disease and partly to changes in weather. We often notice that when the weather changes suddenly to warm, or cold, or damp, that the patient coughs more.

With a little practice patients can reduce the necessary amount of coughing very materially and by so doing prevent harm to the healing lung, and save themselves much physical tiring.

## CHAPTER XVII

## EXPECTORATION

If we were treating tuberculosis when it first makes its appearance as a clinical disease, we would not have to worry very much about expectoration, for early cases have very little secretion; but since most patients under treatment suffer from an advanced stage of the disease, expectoration assumes a place of great interest.

The expectoration in tuberculosis is made up of secretion from several different sources. Some of it comes from the upper respiratory tract, particularly the postnasal space and pharynx, and some from the various mucous glands of the nose and throat. From below the larynx there is the bronchial secretion and the pus thrown off from the broken down tubercles. Then there is added to this more or less saliva.

From the nature of the elements which go to make it up, it is evident that its character and amount are both subject to frequent changes. The variation is greater in advanced tuberculosis where there is much discharge from ulcerative surfaces and where the bronchial secretion is also marked.

In early tuberculosis the patient need have little worry on account of these discharges, for they will usually disappear as the disease heals; but in advanced cases where much destruction of lung tissue has occurred, the expectoration disappears slowly. In fact, the best result that can be attained often leaves the patient with one or more secreting cavities. It has been my observation, however, that if patients will be faithful and keep up their fight over a sufficiently long time, that many more can secure a drying up of their secretion than has been believed. If they cannot, a cavity, well walled off, is not a great danger to the patient although it is inconvenient to have to empty its contents every morning as usually must be done.

It is my experience that patients who have had much breaking down of tissue in the lung, even though they should become bacillus free, are apt, now and then, when having acute colds or bronchitis, to throw off bacilli; so it is necessary for them to be careful and destroy all sputum, and take extra precautions at this time, especially if they are mingling with children. The finding of bacilli in the expectoraton at ths time does not necessarily mean that the disease has assumed a dangerous clinical activity again. It requires careful diagnostic acumen and clinical judgment at times to know just what the status of the patient really is.

It is always safe, however, for the patient to exercise judgment and take good care of himself until all doubt has cleared away.

The amount and character of expectoration keeps changing from time to time until it disappears. These changes occur with the breaking down and healing of tubercles, also according to the amount of secretions from other sources, especially that from accompanying bronchitis. The expectoration is greatly influenced by changes in weather, the amount being greater during damp weather than when it is dry. This is due partly to increased bronchial secretion and partly to the fact that expired air is saturated with moisture and the drier it enters the bronchi, the more moisture will it carry off.

It is difficult for patients to understand the changes which take place in the amount of expectoration from time to time, particularly the increases that occur. They cannot understand how the expectoration can increase if they are improving. This is perfectly clear to the one who understands the processes that are going on in the lungs. The patient's conception is apt to be that of a continued healing from the time that treatment begins; but such a conception does not take into consideration the nature of tuberculosis. The tuberculous lung contains many tubercles. These

are in many different pathologic states. Some are so small that they can only be seen by a microscope. Others, made by the fusing of many together, are as large as peas, marbles or walnuts, and some even larger. Some of these are made up of cells which for the most part are healthy, others of cells which show necrosis and softening. Some have already broken down, leaving cavities, and some of those which have not broken down have so many dead cells in them that they cannot heal, and will have to break down later. These do not all break at once. Some may break in the early period of treatment, others may break later after the patient thinks all danger of such an occurrence is past.

The breaking down of this tissue with its accompanying increase of expectoration is disappointing, but should not be discouraging, because tissue whose vitality is so uncertain is better out than in the lung, as the lung cannot heal securely with it there. This sloughing out of necrotic areas must be looked upon as being conservative. While the process is slow, it is the same process as the surgeon uses when he curettes out necrotic tissue. It gives the lung a chance to heal by getting rid of it.

Not every increase of expectoration, however, is due directly to the tuberculosis process. There are continuous changes which are due to postnasal, throat and bronchial secretion, which, while an-

noying, do not indicate any increased disturbance in the tuberculous process.

As the expectoration varies, so do the numbers of tubercle bacilli found vary. The tubercle bacilli come from ulcerated surfaces produced by the breaking down of tubercles. From this it can be readily understood that the number of tubercle bacilli in the sputum will vary from time to time. The changing numbers found on examination often cause patients to worry unnecessarily. When bacilli first disappear from the sputum they are apt to return again. This also proves to be disappointing to many, but by understanding the nature of tuberculosis it readily can be seen that this must be, for some tubercles are bound to break down after others have ceased to throw off bacilli. The numbers of tubercle bacilli found in the sputum must vary from time to time the same as the amount of cough, the amount of expectoration and pain.

## CHAPTER XVIII

## PAIN

Fortunately for those who suffer from tuberculosis, it is a comparatively painless disease. The disease, itself, as it affects the lung, produces no acute pain at all. When it affects the pleura, however, then it becomes at times excruciatingly painful. It is especially severe and distressing if the patient, at the same time, has a severe cough.

Pain from the lungs proper expresses itself in the shoulders and in the area between the shoulder blades. It is a sensation of discomfort, tiring or aching rather than true pain. There is also a sensation of discomfort or "deep pain" which comes now and then when the lung is involved which seems to be in the flat muscles of the anterior and posterior surface of the upper chest. This is sometimes recognized as a soreness, particularly on pressure.

Disease of the viscera shows very many degrees of pain. Pains resulting from disease of hollow organs such as the heart, appendix, gall bladder and ducts, and ureter are much more severe than those in solid organs, for the former becomes distended during inflammation, and distention is a greater stimulus to pain than simple inflammation.

In the lung, on the other hand, there is simply a continuous irritation of nerve endings by a slow-going inflammation, and this causes unpleasant tiring and aching rather than acute pain. When the pleura is involved, the condition is different. Here we have two inflamed surfaces grating on each other at every inspiration and expiration and on every cough. Then, too, the nerves supplying the pleura are much more sensitive to pain than those in the lung.

Reflex painful sensations are often considered to be rheumatic in nature; and in this day when we have learned of the relation which often exists between a neuritis and rheumatism on the one hand and a focus of pus in the tonsils or about the roots of the teeth on the other, we find that tuberculous patients are sometimes erroneously subjected to operations on the teeth and tonsils for these pains.

Pleurisy is often accompanied by severe pain. The severity of the pain depends upon the location of the pleural inflammation. We find on examining bodies, postmortem, that there is often evidence of extensive pleurisy over the apices of the lungs when little or no discomfort had been noted during life. In fact, we now and then find evidence of an extensive pleurisy involving the entire pleural surface of the lung without the patient's being able to give a history of ever having had acute pain.

Pleurisy at the apex, as a rule, is not very painful because in this area there is little movement of the pleural leaves on each other. Near the base, on the other hand, the pleura covering the lung and the one covering the ribs glide over each other to a distance of from one to two inches. If inflammation involves the parts where the motion is great, the pain is often severe.

As a result of tuberculosis of the lungs or pleura, the nerves which show these changes in sensation when the disease is acute become very irritable. They get in such a state of irritability that they react with pain or discomfort or aching very easily. They show this when the patient becomes tired or is worried about something, or with changes in weather. This return of pain is apt to depress the patient and make him think that his lungs are worse. Not being able to distinguish between the location of the pain from the lungs and that from the pleura, the patient usually considers that every annoying sensation over the chest area is from the lungs, and that it means an active disease; but such is not the case. It is usually a great comfort for the patient to know that these pains are not significant of activity. He should also be made aware of the fact that he must expect these painful sensations to recur for a long time under the conditions mentioned above.

## CHAPTER XIX

## HEMORRHAGE

No other symptom accompanying tuberculosis is dreaded so much as hemorrhage. The very dread, too, has an influence in raising blood pressure and increasing the tendency for the bleeding to continue when it has once started.

Hemorrhage or blood spitting, for we must include all blood which comes from the lung in our discussion, comes very often in the course of tuberculosis. Some patients, however, will pass through the entire course of the disease without coughing up any blood, while others will spit blood every once in a while.

Hemorrhages, particularly the profuse ones, are usually associated in the minds of the laity with a serious form of the disease. It is not infrequently that the patient when trying to impress the lightness of his infection upon the physician, uses as the convincing argument the fact that "he has never had hemorrhages." The fact of having or not having hemorrhages, as far as I have been able to determine, has nothing to do with the prognosis in a given case. A hemorrhage is simply

an accident. It results from an inflammatory condition in the lung which either produces a break in a vessel wall or causes a congestion with the escape of blood into the bronchi. The same amount of breaking down of tissue that occurs when a vessel is broken into, occurs often in the course of tuberculosis without the patient knowing it. The only difference is, in one case a blood vessel wall is impaired, in the other it is not.

Patients often worry when blood spitting comes toward the end of treatment, after they have been making good progress. They "cannot see how they can have a hemorrhage when they are doing so well." And they often declare that "they thought they were way beyond the time when there was danger of such a thing." They should know that a hemorrhage might be caused by the last tubercle in the lung, provided it ruptured and in so doing injured a blood vessel. A hemorrhage does not indicate the state or the seriousness of the disease. It is simply an accident that may occur any time during the course of the disease.

In case of hemorrhage the doctor should always be notified, and until he comes, the patient should recline in bed and, if much blood has been lost, he should lie perfectly quietly, because exertion causes the heart to beat faster and more forcibly and these conditions favor increased bleeding. It is also

necessary for the patient to be composed, for nervousness raises blood pressure and increases the pulse rate and favors continuance of the bleeding.

Physical and mental repose are two of the best measures that we have for combating hemorrhage, and fortunately both can be applied by the patient while waiting for the physician's arrival. The cough should also be controlled as much as possible. Such household measures as eating salt and sucking ice probably act in allaying nervousness and quieting the cough.

While hemorrhages are apt to frighten the patient and his friends, yet the truth about hemorrhages is consoling and reassuring. Patients rarely die in hemorrhage; and as a rule no ill results follow if it is properly treated. So the thing for the patient to do is to accept the reassurance of those who know and maintain physical and mental composure.

## CHAPTER XX

## WEIGHT

The weight of the patient is often taken as a measure of his improvement. Nothing could be more erroneous. More fuss is made over weight than is warranted. To be sure good nutrition is desirable; but good nutrition does not demand an enormous increase in weight. Fat and nutrition are not synonymous.

There are times when it is natural for the patient to lose weight. When suffering from prolonged toxemia, even though the degree is not so great, it is difficult for the patient to hold his weight. He has an increase in his metabolic rate, usually a decrease in his appetite, and an interference with the normal physiologic activity of his body cells. A great many patients of this character can be made to put on weight by forcing the amount of food eaten, but I question the advisability of doing so. I think it far better to eat a fair quantity of food and let the weight drop slightly rather than to attempt to maintain it for a long time by forcing the diet.

Some people are so constituted that no matter how much food they eat or what its character, it

seems impossible for them to put on weight. When they develop tuberculosis it is usually difficult to get them to gain. Others put on weight or hold a high weight on small amounts of food, yet their disease may continue to be active.

Many tuberculous patients, particularly those with long standing disease in which fibrosis predominates, will remain at a stationary weight, probably several pounds below normal, for a long time, and then without any change in diet gain more than their former normal weight. I always look upon this as a favorable sign. It shows a nutritional balance which is very favorable to the patient's recovery.

There is normally a difference in the winter and summer weights of four or five pounds. In the summer it is natural to lose and this loss must not be considered a detriment.

Weight which is put on and preserved by prolonged overfeeding is usually a detriment rather than an advantage. One of the most rational changes that has taken place in the treatment of tuberculosis in the last few years is the discarding of the overfeeding which was almost universal a few years ago.

The progress toward recovery cannot be told by the scales. Fat, flabby patients break down just as often as those who have less weight. Friends

of patients usually judge of the efficacy of treatment by the amount of avoirdupois. They would seem to think that a patient can keep on gaining indefinitely. I often show my patients the absurdity of this by pointing out that the two pounds per week that they work to gain, if kept up for a year, would mean 104 pounds added to their present weight.

Weight, like pulse and temperature, is subject to variations which are natural as long as life exists. Many individuals will note a variation of two or three pounds from week to week; one week up, the next week down. This is but natural; for our habits vary and the physiologic activity of our body cells is not always the same.

A strange psychical fact is often noted when patients keep their own weight charts and are expected to record their weights at given intervals. As long as they are gaining they will put the weight down regularly, but if they are losing, it requires careful watching to keep them recording it. This is a mistake and witholds valuable information from the physician. It is far more important that the physician should know when the patient is losing than when he is gaining.

## CHAPTER XXI

## PULSE

The pulse represents the heart beats. Observation has shown that the normal average pulse for men is about 72 and for women about 78 or 80 beats per minute.

While the pulse represents heart beats, it represents much more than that. It represents the number of beats that the heart is making in order to carry on the work it is doing.

The heart beats in order to make the blood circulate, but it is not the only factor in this mechanism. There are, the elastic arterial walls, the capillaries, the tone of the tissues, particularly the muscles, and other accessory factors such as the suction produced when a breath is taken in.

The circulation responds to the needs of the body. The blood carries food for building tissues and performing work, and the oxygen to oxidize it. The demand on the circulation differs then as the demand of the body for building materials and for oxygen differs.

Whenever there is a demand for more oxygen the pulmonary ventilation increases, the individual

breathes deeper or faster or both. But it is necessary that the increased oxygen taken into the lungs be carried to the tissues where it is needed. This is accomplished by changes in the circulation. While from 3 to 5 liters of blood pass through the heart per minute in the individual at rest, moderate work calls for 8 to 9 liters and hard work may require more than 20.

The heart has two ways of meeting this emergency. It can increase the amount of blood thrown out at each contraction, and it can contract more often. Both of these means are employed. In the trained individual both the heart and skeletal muscles are firm and strong and while the heart responds with both a greater output per contraction and an increased rapidity of contraction, the greatest response is in the amount of blood discharged. The opposite is true of the untrained. The heart and skeletal muscles are soft, and the response is greater in rapidity of contraction rather than in output of blood per contraction.

The heart and skeletal muscles of the tuberculous, while the disease is active and up until the physical strength has been restored by exercise, are weak. The heart responds in the same manner as the heart of the untrained. The difference in cardiac response is illustrated by the following

table from Bainbridge, showing the results of experiments performed by Lindhard and Boothby:

| SUBJECT | | $O_2$ consumption c.c. per minute | Minute volume of heart in litres | Output of heart per beat in c.c. | Pulse-rate |
|---|---|---|---|---|---|
| *Trained* | | | | | |
| (1) | | | | | |
| Resting | | 219 | 3.9 | 59 | 66 |
| Working | | 782 | 9.0 | 100 | 90 |
| (2) | | | | | |
| Resting | | 330 | 4.9 | 72 | 68 |
| Working | | 797 | 11.0 | 127.5 | 86 |
| *Untrained* | | | | | |
| (1) | | | | | |
| Resting | | 185 | 3.57 | 61.5 | 58 |
| Working | | 912 | 9.31 | 70 | 133 |
| (2) | | | | | |
| Resting | | 195 | 4.2 | 69.5 | 61 |
| Working | (a) | 927 | 9.75 | 81.0 | 120 |
| | (b) | 1070 | 10.7 | 71.0 | 150 |

In the figures in the last two columns it will be seen how output increases relatively more than the pulse rate in the trained, and the pulse rate relatively more than the output in the untrained. Whereas the output for the first trained man increased from 59 to 100 c.c. per beat (70 per cent) his pulse increased only from 66 to 90 (36 per cent). The first untrained, on the other hand, increased his output per beat only from 61.5 to 70 c.c. (14 per

cent) but his pulse rate increased from 58 to 133 (130 per cent). This make the pulse rate of the untrained relatively unstable, a fact noted by all observers.

Only so much oxygen can be utilized by the body and the amount differs according to the energy output of the individual. The circulation supplies this amount and is so regulated by nerve centers in the brain that neither a surplus nor a deficiency exists. It will be noted in the above table that the demand for oxygen for a given work is much the same for the trained and untrained.

The contractions of the heart are under nerve control and are influenced by nervous and psychic impulses. This is shown in the athlete. Before he starts to run in the race, impulses from the brain cause his heart to beat faster than normal. Nervous excitement, fright and other such emotions will cause the heart to beat faster than usual. So do the toxins of disease. The increase in rate will often come when no increased demand is made by the body for an increase of oxygen. We must assume then that it is not accompanied by an increase in the heart's output; but as the heart beats faster, the amount of blood expelled at each individual contraction is less than normal.

In this way we explain what occurs in the hearts of our tuberculous patients. It is natural for the

heart to beat faster under many conditions. Every increase in heart beat is not of evil omen. The heart must respond to all demands for oxygen made by the tissues, and it may be influenced by any psychic or nervous influence which stimulate its nerves. It is just as natural for the pulse to be rapid at times, as it is for it to be slow at other times. Patients should learn that these reactions which result from involuntary action are usually well suited to the demands of their bodies. They should learn that there is no absolute normal. If the heart would always beat at 72 beats per minute, as many of them would have it do, they would be helpless invalids and unable to adjust themselves to any emergency. Too much energy is spent in worrying about things which are thoroughly regulated and meeting the requirements of the patient perfectly. When we behold the wonderful complexity of the human body and see how nature adjusts every physiologic activity to the needs of the organism, we should, except under extraordinary conditions, be able to lie down in peace and trust the rate of the heart beat to the wonderful control which has been placed over it and feel satisfied that whether fast or slow it is meeting the demands made upon it.

## CHAPTER XXII

## TEMPERATURE

No one thing gives patients so much concern as their temperatures. This is partly due to the fact that so much is made to depend upon it by the profession. It has been taken as a proof of activity and its absence as the proof of nonactivity. It has been made the basis of opinion as to when the patient should sit up and exercise. In fact, both physician and patient have been slavishly controlled by the temperature curve.

While a carefully kept chart does furnish valuable information as to the nature of the disease, yet its value is in proportion to the knowledge of tuberculosis possessed by the observer. Patients draw many wrong and unjustifiable conclusions from the charts which they keep, and often worry unnecessarily about them.

The temperature is a measure of the body's balance between heat production and heat dissipation. Unfortunately it is usually interpreted in terms of activity of the tuberculous process. There are many things which come into the life of a tuberculous patient which cause a rise in temperature

above the accepted normal of 98.6, which have nothing whatever to do with the tuberculosis. There are rises which are not due to activity in the tuberculous process, but which occur because the patient's nerves which control heat dissipation are stimulated in such a manner that they interfere with the giving off of heat.

A patient with tuberculosis may have any other trouble that a nontuberculous individual may have. He has attacks of indigestion, colds, bronchitis; he becomes nervously excited; he reacts to the summer heat; he now and then eats a hearty meal throwing large quantity of fuel into the tissues; and he reacts to many other conditions which cause a rise of temperature. All of the rises of temperature accompanying these various conditions are apt to be considered as though they were an integral part of the patient's tuberculosis and due to active inflammation. Such is not the case.

Normal female patients usually run a regular curve in which the temperature preceding menstruation is higher than that following. A very common curve is, fourteen days of about 99 or a little over, then a drop with the day of menstruation to normal and a continuation of this for the following two weeks. In the tuberculous patients there is at times a variation in this curve, the temperature running higher during or after the period.

This temperature being normal need cause no concern.

Exercise has a tendency to cause a rise in temperature in those cases of tuberculosis in whom toxemia is present. Exercise produces extra heat. This is the case in the healthy as well as in the tuberculous. A normal person may cause his temperature to go to 104 degrees or even more during hard work but there is nothing to interfere with the nerve control of the blood vessels of the skin and the sweat glands and so the cutaneous vessels dilate, sweating takes place and the excess of heat is dissipated at once. In the tuberculous patient, on the other hand, exercise causes toxins to be thrown out into the tissues which stimulate the nerves controlling heat dissipation in such a way that they are not able fully to respond to the demand for heat elimination; and so the temperature remains elevated.

The temperature curve in tuberculosis assumes many different types. It sometimes assumes elevations in cycles of about two weeks, the maximum reaching normal in the meantime. Again, it persists day after day and week after week with a daily maximum above the normal. Sometimes the morning temperature is near the normal while the maximum for the day is much above what it should be; at other times the morning temperature will

be at 99° or 100° or even more. All of these curves can be interpreted in terms of the character of the active process present.

Another very important question for discussion is what is called sub-normal temperature. Patients often worry because their morning temperatures are below 98.6°. They think that 98.6° is the normal for all times of the day. Instead, a temperature of 98.6 in the morning is just as much a rise as a temperature of 99.5 in the afternoon, for the early morning temperature should be between 97.2 and 98. There is a normal daily variation in the temperature curve of about one and one-half degrees. This starts at about 97.2 or 97.4 in the morning before the activities of the day begin, and reaches 98.4 or 98.6 and in some instances 99, some time in the afternoon.

If patients could only learn that there is no absolute normal, much cause of worry would be taken away. As long as there are differences in human beings, the rate of their metabolic activitiy and the stability of their nervous systems, just so long will there be variations in the normal maximum and minimum temperatures for the day. This variation will not be great, but it will sometimes amount to several tenths of a degree. It must be remembered that the established normal maximum temperature for the day of 98.6 is a composite, and consists of the average maximum of a great group

of temperatures. I do not doubt that some of those represented in that average were 98 and 98.2, while others were 99 and 99.2.

With this discussion, it is plain to see how foolish it is to worry over a rise of temperature of 98.8 as we often find patients doing. It is not uncommon to find the patient endeavoring to keep his chart the same, day after day. He does not care so much for the minimum, but he always wants the maximum to keep under the 98.6. Such a condition could only exist in case the person were dead; because as long as life exists, different demands for energy will be made, and different responses on the part of the heat regulating mechanism will take place, and these will cause variations in the temperature curve.

The temperature in infectious diseases is largely due to the toxins. It is one of the things that the patient can measure. Because of this he thinks of it as an entity. It is not. It is the same as the tired feeling, the exhaustion, the inability to perform work with ease, the rapid heart, the depressed appetite, and the poor digestion. All of these are expressions of the effect of the toxins upon the body. But because we can measure the amount of temperature with a thermometer we magnify its importance. These other symptoms are just as harmful and just as much to be feared; and could we measure them as accurately, doubtless they

would receive their due amount of attention from those who become worried about themselves.

The patient should record his temperature because the physician wants the record and is able to derive certain information from it which is of value in directing his treatment; but he should not be worried about what he finds. Worry will never reduce a toxemia, but it will cause added harmful stimulation to the nervous system which interferes with the heat regulating mechanism, thus interfering with heat dissipation and causing further or continued elevation of the temperature curve. I have seen many instances where temperatures were kept elevated just by worry; and when the rises caused by the disease are slight, the worry will do far more harm than the daily elevation.

It will be noticed that all patients do not bear rises in temperature equally well, nor does the same patient bear it equally well at all times. Sometimes elevation of temperature is accompanied by other toxic symptoms, while in other instances the rise itself seems to be the chief complaint. Some patients, too, are more sensitive to elevations of temperature than others. As long as a rise in temperature is well borne, it should give the patient little concern. Some patients will eat, sleep, put on weight and remain optimistic even through a prolonged course of elevated tempera-

ture. It should be the object of every patient to care for himself in such a way as to minimize the effects of serious symptoms.

There are many things which must be taken into consideration in taking temperatures. Temperatures particularly if taken by mouth, will record more quickly in warm weather than in cold weather. On cold mornings when the cheeks are cold, it will take several minutes, ten or more, to warm the mouth so as to register properly. Sometimes the mouth temperature will be higher when the patient is lying down than when sitting up. This is probably because of gravity. There is not so much blood circulating in the mouth in the sitting as in the reclining posture. In cases with one-sided flushed cheeks, particularly when the flushing is severe, I have seen the temperature when taken on the side of the flushing register more than a degree above that on the other side of the mouth. The temperature should not be taken immediately after drinking either hot or cold drinks, after eating or after cleaning the teeth, washing the face in cold water, or after riding in cold air. All will give erroneous readings.

The thermometer should always be held longer than indicated on the instrument. One minute thermometers should be held at least three minutes, and two and three minute instruments at least five minutes.

## CHAPTER XXIII

## THE DIGESTIVE SYSTEM

A good digestion is of the greatest importance to the tuberculous patient. This has been so emphasized that the patient with transient digestive troubles often takes the matter too seriously. Many patients with digestive troubles can get along apparently as well as those without; but to do this they must exercise judgment and avoid indiscretions.

There are tendencies toward several different types of digestive ills which are common in tuberculosis. In the first place, tuberculosis being a disease which is engrafted onto a human being usually after the age of adolescence, naturally catches him with whatever infirmity or deformity he has acquired. But aside from this it has a tendency to produce certain definite disturbances; or, if already present, to make them worse.

Strange as it may seem, the lung is embryologically formed from the digestive canal; hence it is very intimately connected with it. The vagus nerve which supplies secretory and motor energy to the stomach and intestine also supplies the lungs; so when the lung is inflamed, the stomach

and intestines have a tendency to be reflexly disturbed in their function.

The character of digestive disturbance found in pulmonary tuberculosis is the same as that which is found in chronic appendicitis, and gall bladder diseases. Some of the following symptoms are common: increased muscular activity, increased acidity, gas, intestinal stasis, spastic constipation and colitis. These symptoms send the patient suffering from early tuberculosis to the gastroenterologist more often than to the chest specialist, for their reflex cause is usually not suspected. There is another form of disturbance which usually accompanies the disease when toxemia is present. There is usually a slight rise of temperature, loss of appetite, coated tongue, a dull headache and constipation. The patient usually calls it a "bilious attack," because the symptoms on the part of the gastrointestinal canal are prominent. He disregards the increased cough and expectoration which are usually present. This group of symptoms appearing quite often in the course of chronic tuberculosis, and before the diagnosis is made, often directs the patient's attention to the intestinal tract rather than to the lungs.

Constipation is a common accompaniment of pulmonary tuberculosis. The reflexes from the lung, on the one hand, and the toxemias on the other,

both tend to cause stagnation in the bowel. The effects of neglect of the call of nature in the past, the inactivity, the weakening of the tone of the tissues as a result of the disease, and the concentrated food eaten, all are factors which tend to cause constipation.

The gastrointestinal functions reflect many conditions that affect the patient, not the least of which are under the control of the patient himself. While there are many physical conditions which affect digestion, and which are more or less beyond the patient's control, there are also the symptoms belonging to the group of depressive emotions, such as fear, anxiety, discontent and anger, which interfere as much as organic lesions and which can only be controlled by the patient. Fear, discontent, worry and pessimism in general all do more in interfering with digestion than the physical factors which we meet. How often the patient frets and fusses about his digestion and assumes that the doctor is not doing the correct thing for it, when his own fretting, acting through the nervous system supplying the stomach and intestines, will counteract any good that might come from a given remedy.

The patient, if he would have good digestion, or the best consistent with his condition, must be cheerful and contented and optimistic, and not fret

and worry, for all of these harmful emotions stimulate that particular group of nerves which depress digestive activity.

Patients should know the effect of heat and cold upon digestion, that they may know better how to meet these conditions. Cold stimulates appetite and improves digestion for the simple physiologic reason that the engine must have more fuel to meet the demands made upon it for increased heat production. Warmth depresses the appetite, so there will be less fuel utilized. It also furnishes a smaller stimulus to the cells of the body which are the energy users, and this calls for less food. When a warm spell of weather comes, patients should heed nature's hint and eat less. If they continue to eat heartily, they are apt to suffer from digestive disturbances, because the body does not require, and is unable to take care of, large quantities of food. They fear to lose weight, but what they lose is the stored fat which is a poor conductor of heat and being deposited as a subcutaneous layer serves to retain heat and keep the patient warm. It is physiologic to lose several pounds in summer, and there is no sane reason for not doing so. The loss of appetite, then, when warm weather comes is not to be feared. It is natural and necessary if the patient would adapt himself to the conditions which surround him.

## CHAPTER XXIV

## SLEEP

Sleep is a period of rest for the body. There are certain mechanisms which cannot fully rest during sleep. The heart must beat, respiration must continue and many other functions must be carried on; but even these are carried on at a slower pace than during the waking hours. During sleep that portion of the brain which presides over consciousness rests. It is disconnected, so to speak, from all the nerves which carry sensations to it; consequently the individual is unconscious. The motor system, which depends upon the will, that is, the part which supplies the skeletal muscles, is also at rest. Even parts of the nervous system other than the cerebrum react at a lower rate than during the waking hours.

Sleep is for the purpose of rest. During the waking hours, particularly if work is being performed, the body cells become fatigued. They produce toxic substances which interfere with their normal action. These must be gotten rid of or the individual cannot live. If pups are kept awake for four or five days, they die of exhaustion. The ef-

fect of loss of sleep was shown on the soldiers during the World War. In the battle of the Marne, men marched a distance of one hundred and eighty miles without pitching camp. They are said to have slept while marching; and the few short snatches of sleep thus obtained doubtless saved many lives. Many lay down to sleep at the end of the march and never awakened. The loss of sleep is much harder to bear than lack of food and water.

The amount of sleep required differs at different age periods. The new born child sleeps nearly all the time; and when two or three years old still should sleep about half of the time. Adults require from five to eight or nine hours. It is difficult to ascertain what it is that determines the amount of sleep that a given person requires. One person will seemingly get along just as well on five or six hours as another will on seven or eight. As age comes on, the hours of sleep required seem to lessen.

It is said that sleep is more profound in those parts of the brain which have been most active during the day. The most profound sleep is that of the first hour; and, after the third or fourth hour, sleeping becomes much lighter. This offers a probable explanation for the fact that a nap of ten or fifteen minutes often proves so refreshing.

It is when the sleep is light during the hours preceding waking that dreams occur.

The onset of sleep is caused by fatigue which lessens the power of response of the nervous system to stimulation. For this reason when a person is greatly fatigued, neither light nor noise nor any of the usual stimuli which he would readily notice if rested are sufficient to keep him from sleeping. Hill has suggested that these fatigue substances act upon the vasomotor system and cause a sluggishness of the blood current in the tissues generally, particularly the muscles and abdominal organs, and accordingly the brain fails to secure its normal supply of blood; and, as its anemia increases, sleep comes on.

Tuberculous patients often suffer from insomnia, and this is particularly distressing to them because they feel that their cure depends so much upon proper rest.

There are two common causes of insomnia met with in tuberculous patients throughout the disease; one emotional, that of worry, discontent, fear and anxiety. The patient is not mentally composed but is annoyed by various mental impressions from which he cannot free himself. These mental conditions keep the mind stimulated in much the same way as tea and coffee and prevent the patient from lapsing into unconsciousness.

Another common cause is digestive disturbances. The patient with tuberculosis has a great deal of digestive disturbance. He often suffers from gas in the stomach and bowels, from hypo- or hyperchlorhydria and from a slow emptying of the colon, which is accompanied by the absorption of poisonous substances which interfere with sleep.

Again we now and then find that patients who have had a great deal of fever suffer from insomnia which is due to an acidosis. This can be relieved by the use of alkalies.

No matter what the cause of insomnia, the "will to sleep" is an important factor in its cure. The patient must not worry about the fact that he is not sleeping; or that of itself will keep him from doing so. The patient who dreads seeing night come because he knows he will not sleep, will, in all probability, lie awake. A negative philosophy is a bad thing for one suffering from insomnia. He must gain confidence in himself. He must will to sleep and he must go to his bed with a confidence that he will sleep.

If stomach disturbances are preventing sleep, these should be corrected; if stimulants such as tea and coffee are being used they must be stopped; and then the patient must gain confidence in his ability to sleep. Sometimes sedatives will be nec-

essary, but they should be used only to break the habit and to help the patient to gain confidence in his ability to sleep. They should not be depended on continuously, nor should they ever be used except under the guidance of a physician.

## CHAPTER XVI

## WORRY

Why worry? Worry never helps; but on the contrary always hinders. Regardless of the fact that nothing but harm can be gained by it, everyone worries somewhat. Disappointments, discouragements, fears of something that might happen, the knowledge of things that actually have happened, come to all of us, and for a time at least disturb our equanimity, and fill us with fear and anxiety. A certain amount of worry under such circumstances is unavoidable.

It is not, however, a transient worry that produces the great harm; it is what might be called a worrying state, a condition in which the individual frequently or habitually dwells upon the dark side of the picture, sees more shadow than sunshine, thinks all ill and no good is befalling him. Such a condition has a most disastrous influence upon the individual.

It is doubtful whether any normal man can wholly escape worry, but he does not need to let it take possession of him. In the words of the old adage, "We cannot help the birds flying in the air,

but we do not need to let them make nests in our hair."

Worry unfits one for fighting a disease like tuberculosis. This is a disease which manifests many phases, some of which are more or less discouraging, although not inconsistent with favorable progress and ultimate healing. If the patient is given to worry, he keeps his nerve balance disturbed, thus interfering with the normal physiologic workings of his organs; as a result of which he may lose his appetite, suffer from indigestion, insomnia, fatigue and general depression.

The patient who is given to worry admits defeat. He confesses that he is no longer master of the situation. This is not the proper frame of mind for a winning fight. It shows that he cannot rely on himself. If he cannot rely on himself, it is equally true that he cannot be relied on by others.

Patients must learn that they alone are responsible for the execution of the plans which will restore them to health. The essence of health and happiness is a healthy body presided over by a sane and tranquil mind. When the patient fully realizes the part which he must play, then and then alone will he make the proper effort to overcome tendencies to worry. In the treatment of tuberculosis, it is the frame of mind of the patient, the wholehearted, confident cooperation that helps him most

in getting well. There is no place for pessimism in the program.

The person suffering from such symptoms as loss of appetite, indigestion, constipation, insomnia, rapid heart, fever, palpitation, vague pains and general weakness can increase every one of them by worry; and further, there is not a single one of them that can be relieved in the least by it. So the patient who worries does both himself and his physician an injustice. Sometimes he worries about business and finances, but such worry only retards his progress and makes a greater drain on his resources. If domestic problems worry him, the worry makes him less composed, warps his judgment and unfits him for their solution.

Therefore why worry? It cannot possibly do good, but, on the other hand, defeats the purpose for which the patient is striving. To get well of tuberculosis requires a hard struggle at best; and he who worries and frets is deprived of that greatest of all aids to health and happiness, a tranquil mind and an optimistic spirit.

The course of clinical tuberculosis is such that the various symptoms change in severity from time to time. Periods of freedom from symptoms, or periods when the symptoms are so slight as to cause little annoyance, are followed by periods when the symptoms become worse. The patient

should reason that this is the nature of the disease, it is the game, and that it is nothing to worry about. Worry can only change the disease by making it worse. It reduces the patient's fighting power by irritating and causing an instability in the nervous system which presides over and controls the body functions. It is a physiologic law that the organs of the body require stability on the part of the nervous system as a condition for harmonious action. Worry and equanimity cannot exist in the same individual at the same time.

## CHAPTER XXVI

## CHANGES IN WEATHER

Changes in weather influence everyone. This results from a well-developed nervous system which correlates the actions of all stimuli which affect the individual. This nervous system which receives stimuli of sunshine and shadow, of heat and cold, of dampness and dryness, of wind and calm, has the power to adjust and adapt the organism to these various conditions in such a way as to minimize or prevent injury.

The same human body can withstand an air temperature, if dry, sufficiently high to cook food, on the one hand, and many degrees below zero on the other; an air saturated with moisture or one so dry that it is almost devoid of moisture. It can also adjust itself quickly to these changes.

Changes of weather produce marked effect on the body metabolism. We understand by the term "metabolism" the changes which take place in the body tissues themselves; in the food eaten; and in the intake and output of energy. The importance of this is evident when we realize that the working of the human body depends upon its ability to pro-

duce sufficient energy to maintain itself and at the same time meet all the requirements put upon it for energy of every description. Every different stimulus which affects the body calls for the production and expenditure of energy.

Heat production and dissipation affords an index of the metabolic activity of the individual. We may learn much of the effect of weather changes upon the body then, by studying their effects upon metabolism as shown in the formation and dissipation of heat. Heat production and heat dissipation are both markedly influenced by the nerves in the skin, as is evident from the fact that 85 per cent of the heat of the body is eliminated through the skin.

When cold air strikes the skin, it at once causes an increased tone in the muscles; and, if the degree of cold air is marked, it causes the muscles to contract (producing shivering) during which process heat is produced the same as it is when the muscles are brought into action in the performance of work. This shivering may increase the heat production from 50 to nearly 100 per cent.

This heat is produced for the purpose of keeping the temperature of the body normal. Whether it succeeds or not depends somewhat on the condition of the surrounding air. If the atmosphere is dry, the body heat will not be carried away as

rapidly as if it is damp; and, if the wind movement is slight there is less abstraction of heat than if it is marked. Therefore if the atmosphere is damp and a strong wind is blowing the patient feels chilly. By putting on clothing he envelops himself with a layer of air which becomes warmed by his body heat and protects him from a rapid heat loss.

Water has a capacity for holding heat about 3,000 times greater than air and it conducts heat 240 times better than air. This is of great practical importance in adjusting oneself to cold fogs and cold rain. It explains their chilling influence upon the body. As the dampness penetrates the clothing it abstracts the heat and makes the patient chilly.

Damp cold, particularly if accompanied by wind, abstracts much heat from the body and taxes the patient's heat-producing powers. Unless this is met by a sufficient heat production, the patient remains chilled. When a patient is chilled we have reason to believe that his resistance to disease is lessened, consequently he should use clothing and other means to prevent it. While chilling of short duration works little or no harm to the patient, prolonged chilling cannot be other than harmful.

Cold air, particularly dry cold air, is beneficial. It stimulates the nerve endings in the skin, increases muscle tone and stimulates metabolism.

The appetite and digestion improves and the patient assumes a higher plane of resistance.

While cold air is stimulating, warm air is depressing. The degree of depression produced by it depends upon its water content or humidity; and upon its movement. The most stimulating warm air is dry warm, and the most enervating is moist warm. Warm air is made tolerable by wind movement, and is most enervating when wind is absent.

From the statement above that water holds 3,000 times as much heat as air we may explain the well-recognized fact observed in mountain regions, and in the foothill regions of Southern California back a few miles from the coast all the year around, and in the desert regions particularly in winter, viz., that it may be hot in the sun, but is cool in the shade, that the day may be warm but the nights are cool. The dry air does not hold heat, so as soon as one passes into the shade or as soon as the sun goes down the temperature becomes much cooler. The pleasantness as well as the stimulation to the patient's vital forces depends much on this fact.

In studying the effects of weather changes upon the body we are constantly forced to consider the three factors; temperature, humidity and wind movement, for most of the effects are centered around these factors.

One of the most marvelous powers possessed by

the human body is its power of adapting itself to conditions which require rapid or marked changes in physiologic action. This is illustrated by the aeronaut who within a short space of time changes his physiologic activity from that required at sea level to that of ten, fifteen and twenty thousand feet elevation; and in a much shorter time makes the change coming from elevation to sea level.

One of the interesting adaptations required of the tuberculous patient is the one by which he adjusts himself to changes of air temperature. The manner in which he does it depends very much upon the manner in which his sympathetic nervous system is influenced by the disease as is readily understood from the large amount of heat which is thrown off through the skin. A normal individual may, through marked exertion, raise his body temperature to 103 degrees, or 104 or more; but this immediately causes a response in the capillaries of the skin, by which they dilate and permit large quantities of blood to come to the body surface, exposing it to the surrounding air temperature and cooling it. Heat stroke is prevented by this mechanism. Should the temperature of the air be warm, approaching or surpassing that of the body, then the individual perspires and causes the heat to be thrown off more rapidly. It is interesting to know that while a drop of sweat evaporates on the skin

it carries off sufficient heat from the body to raise two other drops to the boiling point.

The tuberculous patient does not have a normal sympathetic nervous system. It has been injured to a greater or lesser degree by the toxins and other harmful influences which accompany the disease. Consequently he does not have so complete and so rapid a power of adjustment. This is shown by comparing the temperatures of a normal and that of a tuberculous patient after exercise. Both have a marked increase in heat formation during severe exercise. This may be sufficient to raise the temperature in both or only in the tuberculous. The chief difference, however, is in the way they dissipate the heat; the normal dissipates normally, the tuberculous incompletely. This fact has long been recognized, and taken advantage of when tuberculosis has been suspected. Moderate exercise, in the tuberculous, is often followed by a rise of temperature, and if so followed, it is slower in coming to normal than in the healthy individual.

The same disturbance in heat dissipation makes it difficult for the tuberculous to adjust himself to hot weather. Hot waves of temperature are accompanied by similar waves in the patient's temperature. It does not affect those who have good vasomotor control; but those who have not are affected markedly. The toxins in certain amounts

stimulate the cutaneous nerves and cause an increased vasoconstriction. This decreases the amount of blood in the skin and prevents the throwing off of heat. I have seen the temperature of the atmospheric air reach 114 degrees but the patients exposed to it adjusted their heat dissipation so well that their body temperatures varied for the most part less than a degree. Only a few showed a degree and more. The variation in body temperature caused by changes in atmospheric temperature in tuberculous patients is usually from one-half to one degree with a sudden change of ten degrees. The effect is marked in about 10 per cent and shows more in some than in others. The rise is usually greatest on the first day of hot weather, and lessens on the following days, showing that a vasomotor adjustment takes place.

Heat stroke will not occur as long as the patient's powers of dissipating heat are able to functionate. I observe patients every year for a few days when the atmospheric temperature is above 100 degrees. This is always accompanied by a low humidity, consequently the body heat is readily carried off and only about ten per cent show an elevation of body temperature.

The effect of the moisture of the air is a factor which we have had excellent opportunity to observe here in Southern California, where we have

the dampness of the coast and the dryness of the desert within fifty miles of each other, and the moderately dry air of the foothills lying between the two extremes. Patients with much expectoration have it increased at the coast and diminished in the foothills and desert. This may be partially explained by the fact that air entering the lungs comes away saturated with moisture. If it enters saturated it cannot carry away moisture. If, on the other hand, it enters dry it carries off much. Consequently the foothill, desert and mountain climates cause the patients to have less expectoration. I have seen many patients, however, who adjusted themselves readily to the dampness and did well at the beach, and made apparently the same improvement as those living farther inland.

When the atmosphere is warm, patients should use the least covering possible so that the heated air in the neighborhood of the skin can escape and carry the heat away with it. This may be facilitated by wind or by a fan.

## CHAPTER XXVII

## HEAT

One of the chief factors of weather is temperature. Few people are enabled to live surrounded by an atmosphere the temperature of which is always agreeable. One can have an abiding faith, however, in the power of his body to adapt itself to whatever changes may come.

Patients should learn not to fret and worry over weather conditions. They can do themselves far more harm by so doing than will be wrought by the unfavorable weather conditions; and, furthermore, why worry about something that cannot be changed, when there are so many things that can be.

Warm summers are characteristic of most of the populous areas of the temperate zone. The mountains and seashore are usually pleasant in summer; but patents suffering from a chronic disease like tuberculosis cannot change climate every time the weather becomes uncomfortable. Therefore it is necessary that they learn to make the best of the conditions under which they are required to live.

Patients can progress toward cure both in sum-

mer and in winter; and the tubercle bacilli can multiply and destroy the patient in both seasons.

When the weather is warm patients should not worry. They should adapt themselves as well as possible to withstand the heat. The manner in which they are able to adapt themselves depends a great deal upon the patients' ability to keep the proper balance between heat production and heat dissipation, and to eliminate waste from the body.

Work produces heat, and food furnishes the fuel to be consumed. Food also furnishes the fuel to keep the body temperature at normal. As long as the atmospheric temperature is below that of the body this cooler medium of itself abstracts heat from the body; and this of itself calls for fuel which is supplied by food. When the temperature is far below that of the body the amount of fuel required is considerable. When the atmospheric temperature rises, however, and approaches or exceeds that of the body, then the demand is smaller. Consequently when the weather is hot less food should be eaten. The two chief varieties of food utilized in the production of heat are fats and carbohydrates, therefore in hot weather the consumption of both of these should be limited. On the other hand far greater chemical activity resulting in heat production, takes place during the digestion of protein than in the digestion of fats

and carbohydrates, so this too should be limited. Seventeen per cent of the energy producing power of protein is expended in its digestion as previously mentioned.

Since exercise produces heat it is also well for patients to limit the amount of exercise taken on hot days; or take it in those portions of the day when the temperature is lowest.

On hot days much water is lost from the body, so it is advisable for patients to drink freely of water. Cool water is much better than ice water, the latter being prone to disturb digestion. It is also best not to drink too large quantities at one time but to drink oftener. Clothing should also be adapted to the needs of the body. White clothing reflects the sun's rays while dark clothing absorbs them; consequently white clothing is best for summer. Clothing should also be thin and many layers should be avoided; because air becomes imprisoned in the mesh and between the layers of clothing and there it becomes warmed and interferes with the dissipation of heat from the body.

The manner in which heat affects patients depends much upon the humidity. In the desert, air temperature of 120 degrees and even more may be endured without harm because this temperature is accompanied by a low humidity. A temperature of 100 degrees, on the other hand, in the middle west

and eastern portions of our country, where the humidity is high is accompanied by great depression and at times by heat stroke. Where temperature is high and humidity low the shade and nights are cool.

Comfort depends not only upon the degree of temperature and humidity of the atmosphere but also upon wind movement. Wind always favors the abstraction of heat from the body and, at the same time, aids in the elimination of deleterious products through the skin. Therefore a fan, particularly an electric fan, has a very important function in cooling and adding to the comfort of patients in warm weather. It abstracts heat, favors elimination of waste products and produces a stimulation through the sensory skin nerves which aids metabolism. Sometimes its effect is too marked when it blows continuously, directly upon the patient; and it is better to have it removed some distance to make the wind movement more gentle.

## CHAPTER XXVIII

## COLD

Many patients are much distressed by cold weather. Much of this disturbance, however, is mental rather than physical. All patients cannot adjust themselves to cold weather with equal ease. Cold air is stimulating, thus cold weather makes relatively greater demands upon the reactive powers of the body than warm weather.

If the patient adjusts himself to the cold he does so by eating more food than is required by warm weather, and by putting on clothing which retains the body heat and by the use of artificial measures for heating the surrounding atmosphere.

Cold weather in the temperate zones comes on in seasons. It is preceded by a season of transition from the warmth of summer. The weather gradually grows colder over a period of several weeks. This gradual increase of cold awakens the reactive forces of the body. It stimulates the appetite so that more food is eaten. The food that is ingested beyond that necessary for the body requirements is deposited as fat under the skin where it interferes with the escape of heat from the body. Cold quick-

ens the building up and tearing down processes in the body and prepares the individual for the cold winter weather which is approaching.

Whether or not the winter is beneficial or harmful depends very much upon the manner in which the body responds to the stimulus to its vital forces. Many patients say that they cannot stand cold. Some believe this erroneously; yet there are those whose physiologic powers of adaption are so out of gear that they are not able to meet the extra demands. Many such patients, however, can have their resistance raised to such a point that they withstand the cold well. This may be accomplished by a gradual exposure to cold, while at the same time other methods of hardening the patient are employed. It is foolhardy to think that all patients can be most advantageously treated by exposing them to the bitter cold of a rigorous winter. Cold the same as other measures is advantageous only if the patient reacts to it.

Cold, *per se,* is not a cure for tuberculosis, although it has recently been lauded as such. It is a strong stimulus to the patient's reacting powers, however, and, if the patient adapts himself well to it, the tone of the muscles improves, the appetite increases, metabolism quickens and a favorable condition of physiologic action is established.

Patients react most easily to dry cold with little

wind movement. On the other hand, damp cold with strong wind taxes the reacting powers of those who are most robust.

When patients are to begin the outdoor life in cold countries in the winter time, they should use caution and not demand a greater physiologic response than their bodies are able to give. It is better to try the procedure at first, if possible, when the weather is not too cold. The degree of cold can be mitigated by protection from wind, by the use of clothing and bed covers and by such artificial means of heating as hot water bottles and electric pads.

In attempting to adapt oneself to intense cold, one should not depart from physiologic principles. In the chapter on open air and clothing I discussed the importance of skin ventilation, I showed how the beneficial effects of open air depends greatly upon the stimulus received by the delicate network of sensory nerves which are found in the skin. Bearing this in mind, it is plain that baking one's skin with hot water bottles and electric pads and covering oneself with numerous thicknesses of clothing which are impermeable to the air does much to take away the beneficial effects of the open air life.

Cold, if the patient reacts well to it, then, should be beneficial rather than harmful, because of its

general stimulating effect upon the vital forces; and winter should exercise a beneficial influence upon tuberculous patients who react well to cold. Cold, however, cannot be considered alone. There are other factors which must be taken into account.

The patient comes up to the approach of winter with his resistance raised by the gradually increasing cold of the autumn. When winter sets in he is confined more or less indoors with artificial heat which lowers his resisting powers, and at the same time he is subjected to greater danger of infections. By the time spring comes his reacting powers are impaired, and his resistance lowered and consequently he is apt to emerge from the winter weaker than he was in the autumn. This is not a necessary result of the cold, but it is a common outcome. It requires much pluck and determination for a tuberculous patient to live in the same house with well people and remain in the open air during a cold winter, while others enjoy the cozy warmth of a heated apartment.

## CHAPTER XXIX

## CLOTHING

Since we have learned that the beneficial effect of open air is largely due to the impact of air upon the sensory nerves of the skin, clothing becomes a matter of great concern. Clothing can aid the open air treatment, or it can vitiate its beneficial effects.

For the full effects of open air, the skin must be well ventilated. No skin covered by clothing is as healthy and as capable of reaction as the one which is uncovered and exposed to the air. No doubt much of the value that comes from the so-called "back to nature cure," in which exposing the body to light and air forms an integral part, is derived from the stimulating influences of light and air upon the nerves of the skin.

Clothing must be adjusted to climatic and weather conditions. Many people sleep out of doors but destroy the value of the measure by covering the body with impermeable clothing. Nature provides the body with a covering of fat which changes with weather conditions. It is thicker in winter than in summer. This fat interferes with the dissi-

pation of heat and in this way keeps the individual warm. Civilized man covers himself with artificial clothing which surrounds the body and interferes with heat dissipation and thus keeps him warm. While this keeps him warm it at the same time interferes with the normal reacting powers of the skin. Darwin describes having seen women and even babies in Tierra del Fuego standing naked in cold sleet. Their protection was their natural fat which was rendered still more impermeable by a coating of fresh oil. The people were comfortable and exceptionally healthy.

Garments covering the skin confine a layer of air which increases in temperature above that of the outside air. This becomes stagnant and prevents a rapid exchange with the outside air, and in this way keeps the patient warm. Every successive garment confines another layer of stationary air and this renders the elimination of heat more difficult. If the garments are not sufficient to prevent the wind from penetrating and expelling the confined air the patient feels cold. During cold weather it is necessary to have confined stagnant air next to the body in order to be comfortable, while in summer this same condition prevents heat dissipation and makes the patient very uncomfortable.

Clothing acts differently when wet and when dry.

When dry, wool, cotton, and linen are all capable of keeping the body warm; but when they become wet, cotton and linen fit close to the skin and conduct heat away much more rapidly than wool, which does not stick to the skin; so they are not nearly so valuable in keeping the body warm. Wool therefore is desirable when the body is to be kept warm; and cotton, linen or silk when it is to be kept cool. Wool is particularly valuable in damp cold climates.

Patients should wear the least amount of clothing compatible with comfort, so that their skins may receive as much stimulation as possible from the circulating air. This is true in both winter and summer and regardless of the character of the garment. Too much clothing injures the skin and its reactive powers. Patients who wear too much clothing find it difficult to harden themselves because while subjecting themselves to conditions which require a healthy active skin they interfere with its reacting by too much clothing.

The patient who goes to bed with so many covers that he is made tired by their weight is not in the proper reacting condition to harden himself against cold, and to build up a vigorous resistance against disease. Such a patient may have his skin educated by cold sponges, followed by a vigorous rubbing, and also by air, sun and light baths.

## CHAPTER XXX

## FOG AND RAIN

Are fog and rain detrimental to the tuberculous patient? Too often in discussing such questions we lose sight of the fact that no one thing, such as fog or rain, can operate to the exclusion of other things. If a patient had to live in fog all the time; or in a place where there was constant rain, there would have to be many other factors operating to cure his disease to make such a result possible.

Many places which possess good climatic conditions for overcoming tuberculosis are visited by frequent fogs, and others by frequent rains. Fog and rain may interfere at times with the progress of patients suffering from tuberculosis; but neither of them injures the patient to the extent that he often thinks they do or to the same degree that many of his own indiscretions do.

The patient with tuberculosis must learn that his getting well does not depend alone on conditions of weather; nor is there any one weather factor which is likely to prove his undoing, provided he conscientiously follows modern methods of cure.

Fogs, if cold, are very penetrating, and thus pro-

duce chilling, but any evil effects that might come from this may be overcome by dressing warmly. Fogs sometimes seem to be responsible for bronchitis. This is not so easily overcome; yet I have found that patients who are hardened by open air sleeping and cold baths do not suffer as much as those who are not. A well-trained resistant patient will not be troubled much by fog.

Much the same may be said of rain. There is a great difference between cold and warm rains. The former chill, the latter, if excessively warm, enervate. A damp cold rain with strong wind furnishes conditions which abstract much heat from the body, and require strong reacting powers on the part of the patient, in order for him to adjust himself to them.

The fortunate thing about such conditions of weather is that they are usually of short duration; and further, the patient, by exercising care, can avoid whatever harmful influences there are in them.

When patients live in localities where there is much rain, they should look well to the protection of their beds, provide themselves with umbrellas, good shoes, rubbers and coats which will turn the rain, so that when they are on exercise, they need not be deterred by the fact that it is raining. Patients who are properly provided with clothing can

take their exercise in the open in rainy weather, unless the rain be excessive, and still return warm and dry. It should not be necessary to say that foolhardiness should be avoided. There will be times when prudence will demand that the patient forego his walk; but the fear of having tuberculous patients go out in any rain is unfounded.

When fogs come frequently and last long, or when cloud and rain persist for days, patients are apt to fret and worry lest they will be harmed; but the fretting and worrying will probably do them more harm than the weather conditions. When surrounded by clouds it is all the more necessary to have sunshine within.

## CHAPTER XXXI

## COOPERATION

It is the duty of every patient to get into harmony with the regime or program which is instituted for his cure. It is not only a duty, but it is greatly to his advantage that he should do so.

There are always some patients who follow any direction with reservations. They think they have their doubts about the wisdom or the necessity of doing what is asked of them. In reality, however, it is not so much that they doubt the advisability of the program, but rather that they have an unwillingness to cooperate. They usually decieve themselves into believing that their lack of cooperation is due to a failure to approve of the course. The physician, however, if he is alert, sees more than this in the case. He recognizes an unwillingness to obey and an antagonism which means future trouble.

The patient with tuberculosis should choose as his physician a man in whom he has confidence. He should then put himself under his care, and work with him in the spirit of closest cooperation. He has no right, neither can he afford, to retain

him as a physician unless he has full confidence in him. The patient should assume that the physician knows more about tuberculosis and its cure than he does. If not, he does not require his services. These two should start out in the business of cure as partners. Both desire the same end.

Tuberculosis being a chronic disease, its treatment extends over a long period of time, during which the physician must direct and the patient must obey. Cooperation is not so difficult if an attitude of frankness is maintained. The physician must always be interested in his patient and mindful of his best good, and the patient must be willing and anxious to do everything that offers help. In order to secure cooperation, the physician must be able and willing to explain to the patient the various conditions as they arise, so that he may cooperate intelligently.

This cooperation must continue until the disease has been thoroughly arrested. The patient usually feels well when the symptoms subside, and nothing but the most perfect confidence in his physician will keep him interested in treatment during that still long time which must elapse before his disease will have become permanently arrested. A small percentage of patients give up treatment immediately after the annoying symptoms subside, and yet remain well. These instances often tempt

others to follow their example. This course is dangerous, and if the entire number doing so were carefully followed, it would readily show the foolhardiness of such a course; for the great majority of those so doing eventually lose their lives. Only the utmost confidence of the patient in his physician is able at times to prevent such a catastrophe from happening.

In order to secure cooperation the patient must be made to understand the character of the disease that he is fighting, so that he will know why it is necessary for him to closely follow a definite program, foregoing seemingly harmless pleasures and avoiding the activities of the business and social world. He will then understand why he must keep his defensive powers active, so as not to permit the bacilli to obtain the upper hand. It is all but impossible to secure this necessary cooperation unless the patient knows why it is required. It is an insult to his intelligence to ask him to rest, remain out of doors, give up business and follow such instructions as are usually given in the treatment of tuberculosis, when he has no definite idea of why he is doing it. How often do we hear patients say: "Had I known I had tuberculosis I would have done differently. I would have avoided doing many harmful things which I did and would have done many helpful things which I omitted doing."

Tuberculosis improves slowly. The patient should know that it requires not only a few months, but often years, in tuberculosis to produce a favorable result, and the physician has no right to expect cooperation during all this period if he minimizes the disease by calling it such things as "throat trouble" and "bronchitis."

There are many exacerbations which come on during the course of the disease which must be explained. During the long course of tuberculosis, after it has reached the active stage, there are periods of increased activity every now and then. The disease in certain portions of the lung becomes more acute; the tubercles soften and rupture. These changes are accompanied by certain symptoms. Sometimes the most prominent symptoms are on the part of the gastrointestinal tract; at other times cough and expectoration are increased; again, fever with general symptoms of toxemia are predominant. Physicians often attempt to satisfy their patients by calling these attacks by such terms as "stomach disturbance," "la grippe," or "bronchitis." In doing so they admit that they are poor physicians, not to be able to cure such simple troubles. It is no wonder that patients who are held in such ignorance, become discouraged and usually drift to other physicians; or, if their confidence is sufficient in their attendant, give up the

fight and go on to death. Physicians who treat their patients in such a manner as this cannot help having little faith in the curability of tuberculosis. They neither do themselves justice, nor give their patients a chance to get well. Such a policy is not calculated to inspire confidence sufficient to tide over the many crises which occur; and to keep the patient buoyed up until a final result has been obtained. Keeping the patient in ignorance also fails to secure the necessary cooperation in carrying out the hygienic regime which is necessary to prevent spreading of infection. When the physician tells the patient that he has tuberculosis, and that, unless he uses extreme care, he may infect his children and other dear ones, he will usually, particularly if the patient belongs to the intelligent class, be met with a willingness to carry out such care in personal hygiene as is necessary to make himself harmless. Those who are so selfish as not to be willing to take such precautions, should be forcibly compelled to do so by law.

If a relationship of candor and confidence between physician and patient is entered into at the beginning of treatment, confidence will continue to grow as the patient's improvement follows. His increased faith in his physician's knowledge, as proven by the course of the disease, as time goes on will help him through many trials and discourage-

ments which are bound to beset the path of all who are attempting to throw off a chronic tuberculous infection.

Tuberculosis, as I have stated elsewhere, is a many-sided disease. It affects all of the leading systems of the body—the respiratory, circulatory, digestive, and nervous. If the physician bears this fact in mind he will be able to explain the various symptoms which manifest themselves on the part of each system, upon a physiologic basis; and, while the explanation does not relieve the symptoms, it satisfies the patient and secures greater cooperation. The patient, by knowing is relieved of unnecessary worry.

In order to merit the cooperation of the patient, it is needless to say that the physician should possess a comprehensive understanding of the disease. He should no less have a comprehensive understanding of his patient. There is no particular psychology to the tuberculous patient which does not hold with other people; but there are certain definite psychological states present during this disease which should be recognized, because they will greatly aid in securing a whole-hearted cooperation.

From what I have written thus far it can be readily understood that cooperation depends upon intelligence. A great deal of the disagreement and

confusion which arises in discussing the subject of tuberculosis comes from one man observing intelligent patients, who will cooperate, while another's experience is gained among the ignorant, and those who will not cooperate. A certain amount of intelligence is essential to obtaining an arrestment in tuberculosis. It cannot be taken from this statement that people who are considered intelligent in ordinary things, will always make the best patients.

The patients belonging to the most favorable class as far as results are concerned are those who take an intelligent view of the disease, and who are willing to submit to regulation and endure what deprivations are necessary in order to get well. This class is made up largely of the middle class, economically. It is very difficult to secure intelligent cooperation from the wealthy or from the extremely poor, particularly the ignorant poor. A man may be intelligent from the general standpoint, but he may use very poor judgment in his cooperation for cure.

No two physicians can deal with their patients exactly alike, yet each one may obtain satisfactory results. It is necessary for a man to deal according to his own individuality, consequently, there is no place for dogmatism in outlining rules for caring for the patient, any more than in conducting a

case at law. Therefore a patient must not expect his physician to do just the same as some other physician.

I obtain the best results by making my patients intelligent upon the subject of tuberculosis. Patients should know the nature of the disease, something of its course, the difficulties in the way of cure, complications that may arise, aids to cure, and their own part in bringing it about. They should realize fully that the final result depends very largely upon themselves.

The patient suffering from active tuberculosis should be prepared for ups and downs, which are almost sure to come before he can secure a satisfactory result. He should know if he has not yet reached the temperature stage, that he probably will before he is through. He should further know that these stages of activity are a part of the general process,—that they will come no matter what line of treatment is followed. He must understand that he will feel badly during these times, but that they are only incidents in the course of a long drawn out disease and not necessarily serious. The course of tuberculosis is much like a long automobile ride. Every now and then rough places may be found in the road; in fact, the roughest places may as well be just before the destination has been reached, as at any other part of the journey. These

rough places do not indicate that we are not progressing favorably in our course. They are only a part of it, and are as essential to the journey as the smoother stretches. Fortunately, while the rough places make the journey unpleasant, they do not prevent reaching the destination.

I have never liked the idea of governing patients by threats. The relationship between the physician and the patient should be one of mutual interest and sympathy, and the patient should not be handled by compulsion. To be sure, compulsion will be necessary now and then with individuals of a certain type, but I believe it is a mistake to attempt to handle the great mass of tuberculous patients in this manner. By far the greater portion of patients are tractable. It is only a few who are vicious. The dog responds to kindness, and it is rare that a human being becomes so low that kindness will not have some influence upon him. It is well always to bear in mind that the tuberculous patient is a thinking, hoping human being, not a machine or dumb animal.

A class of patients which is very difficult to handle is composed of those who have preconceived notions, who are thoroughly satisfied with their own knowledge and ability, and who yield slowly to the ideas of others. Patience and tact will usually manage this class by displacing wrong ideas

by right ones. Patients should not be asked to do things for which a plausible reason cannot be given. A plausible reason helps to secure cooperation.

The fact that tuberculous patients are necessarily under treatment for a long time brings about a different relationship between physician and patient from that which exists in acute diseases. No man who has the spirit of humanity in him can observe the struggles that these patients are making day after day, week after week, month after month, and at times year after year, watch their efforts at cooperation, and know the way in which they are depriving themselves of the enjoyments to which they are accustomed, without becoming warmly attached to them. During all this period, too, the patient looks to the physician for guidance in every important particular. This brings an added sense of closeness, and it also adds to the responsibility. The physician is the guiding hand. He becomes the father confessor to the patient, as well as his physician.

I do not believe that it is possible for a physician to produce as good results in the treatment of tuberculosis by holding himself aloof from patients and treating them coldly, as by entering into their lives, taking an active interest in their welfare, and showing them that he is a human being, en-

dowed with the attributes of kindness and sympathy. Such a physician commands confidence on the part of his patient, not only because the patient thinks it offers him the best chances of cure, but also because his personality demands it. These attributes were exemplified most perfectly in Trudeau, whose humanity and sympathetic kindness proved an inspiration to countless numbers who were struggling for the mastery of this disease.

## CHAPTER XXII

## PROGRAM

Most people are unsystematic. When an unsystematic person takes upon himself so serious a task as getting well of tuberculosis, he has a difficult job ahead of him. The first thing he should do is to learn to program. He is going to be compelled to live a life in which he must conserve energy for a period sufficiently long for recovery to take place. If unsystematic he will retard his progress. He will fail to do things that he should do and will do things that should be left undone. The systematic patient, on the other hand, falls into the routine with little trouble and makes getting well his only business for the time.

Experience teaches that the one who will not program is very unsatisfactory as a patient and that he has a bad influence on other patients with whom he comes in contact. He is the one who gives the physician troubles in a sanatorium. He will not obey rules himself and he prevents others from doing so. Some patients of this type are good natured in their disobedience. They simply do not seem to have the strength of character to do the

things that they know they should. These can often be helped and brought into a spirit of co-operation which will suffice for overcoming their troubles. There is another type which is willful and determined to disregard all rules no matter what happens. Such patients are extremely difficult to help. Such patients should remember that no one can cure them. They must cure themselves. They not only make it difficult for the physician, but they interfere with their own progress and that of others.

The program which is adopted by those who treat tuberculosis is based on study and experience. It is not adopted for fun or for punishment of patients. It is the program which seems necessary to give the best results in treating this disease. The patient then should adjust himself to it. He should accept it and pursue it whole-heartedly.

The program for the tuberculous differs very much from that followed by people in health, and this makes it difficult to pursue in the home. To follow out a rigid systematic life when in the midst of those who live unsystematically is a task which taxes the character of the patient. In an institution devoted to the cure of tuberculosis, on the other hand, all live the same life and the temptation to depart from this program is not so great.

The sanatorium life is a life of program; and

the home treatment is successful to the extent that it is able to adopt it. Not only is it necessary to follow out a program while getting well of tuberculosis; but it is necessary to follow out a modified program for years. The program for cure must be carried out in a modified form after the patient goes back into family life; and the more whole-heartedly he has carried it out before, the easier it will be there. Patients should get to the place where their progrom is second nature, and where it is harder to break it than to follow it.

The patient beginning the treatment of tuberculosis should recognize that the general tendency for active tuberculosis when let alone is to become more active. He should also realize the fact that if the situation is properly faced, and the correct measures are whole-heartedly carried out, the chances for restoration to health are very much increased. With proper cooperation on the part of the patient, following the established program for treatment of tuberculosis, nearly all early cases should be returned to health; and a fair percentage of those who are farther advanced. The irresponsible, and undisciplined patient, however, can easily destroy his chances of cure.

If life is worth while, the patient should make an effort to find the correct program; and when found, follow it to the letter. In the chapter on

Home Treatment will be found a program which has proven to be exceedingly well adapted to carrying out the principles underlying the modern treatment of tuberculosis.

The program for the tuberculous is a program of hygienic living in which the patient's strength is built up and conserved over a time sufficiently long for the disease to be mastered. It consists in adjusting the hours of sleep, the time of meals, the quantity and quality of food, the rest, character and amount of exercise, the care of the skin, baths, clothing, in fact the whole life to the requirements and strength of the individual.

## CHAPTER XXXIII

## HOW MUCH SHALL THE PATIENT KNOW?

The best patient is the intelligent patient. Patients should be acquainted with the essential facts about the disease. They should know that implantation usually takes place in childhood; and understand the relationship of this early infection to the clinical disease. They should understand the slowness with which clinical disease often develops, and the course that it is likely to take after it has once become an active disease.

They should then be told of the seriousnss of the disease when left to its own development and the hopefulness of it when treated properly. The nature of cure should be explained so that the patient will understand the program which is outlined for him and be willing to cooperate.

Since we have no specific remedy that can be used in treatment, it is necessary to apply many measures which seem very simple to the patient. In fact they are so simple that they make the cure difficult. Unless the patient understands why they are employed he will rarely cooperate fully, and he will underrate the necessity of doing the essential things.

There formerly was strong prejudice against the patient knowing anything about his disease; in fact, there was much opposition to telling him that he had tuberculosis. That, however, was in the old days of pessimism when a diagnosis of tuberculosis sealed the patient's fate. Today all has changed and tuberculosis when treated intelligently at the proper time has become one of the most hopeful of all chronic diseases. It is much less common now than formerly that a member of the family rushes ahead to tell the doctor to "please not tell the patient if anything is found." This change has come through the great number of clinical cures that have been made. Nearly everybody now knows of someone who has gotten well of tuberculosis; if not, he can find some one if he will go to a little trouble. This is a very different situation from that of a quarter of a century ago when to have a diagnosis made meant sure loss of life. Early diagnosis and intelligent treatment, and, a public educated to the truths about tuberculosis have transformed it into a disease to be dreaded not so much because of the danger to life but mainly because of the inconvenience and sacrifice that treatment entails.

The nature of the disease demands that the patient know that he has it; and he cannot be given the advantage of scientific treatment without such

knowledge. How can one expect a patient to go to bed and rest during the period in which his disease is active unless he knows the reason for so doing? How can one expect a patient to give up business and make the sacrifices attendant upon such a course unless he knows why? How can one expect him to pursue treatment over the months necessary for an arrestment unless he has an intelligent reason for so doing? Why would he exert care to avoid scattering infection and communicating disease to others unless he knew the nature of his disease? He who tries to keep the tuberculous patient ignorant of the nature of his trouble, except in the very rarest of instances, does himself an injustice and his patient an injury and assumes a risk of causing the disease to be needlessly conveyed to others.

Make the patient intelligent. If the knowledge of having the disease is going to produce a lasting harm from which the patient cannot recover, then this patient is so weak that he will have little opportunity to recover anyway; but the knowledge may save others, especially children, from becoming infected. Fortunately the human mind is so constituted that it can adjust itself to shock and disappointments. After a few days living even with the most serious events that come into our lives we become benumbed to them and their se-

riousness becomes minimized. It is fortunate that it is so. So the patient soon becomes accustomed to the fact of having tuberculosis; and after a few days is ready to take up the fight for cure with zeal and earnestness. When the shock is once over and the patient begins to learn something of the nature of the disease and its curability, he then begins to take stock and nearly always proves to himself that he will win in his fight. The dejection is then over and the fight for mastery has begun.

Patients' feelings should be spared in telling them of their troubles and they should always be apprised of the fact of its curability at the same time, thus receiving a note of warning and a message of hope simultaneously. Why should early tuberculosis carry so much gloom? It will yield to treatment in a larger percentage of cases than pneumonia, and typhoid fever. In fact there are few diseases which offer a better prognosis when intelligently treated than early tuberculosis.

A physician who understands tuberculosis, and a patient who knows the essential truths about the disease and the reason for following the program laid down, provided he will cooperate, will bring a large majority of early and moderately advanced cases of tuberculosis to a favorable issue, and will even arrest many of those which are far advanced. It is the patient's right and duty to know.

## CHAPTER XXXIV

## SANATORIUM

There is nothing magical in a sanatorium which of itself will cure tuberculosis. It requires the same cooperation of patient and physician as is required on the outside; but if this cooperation is had, the chances of producing a favorable result are much greater, for a properly constructed and managed sanatorium offers the ideal conditions for the treatment of tuberculosis.

Sanatoria are especially adapted to carrying out the measures and methods which are recognized as having curative properties. The patient with tuberculosis needs special care. He requires conditions which are not found in the ordinary home, and needs them for a long period of time. Those who are well will not submit to these conditions themselves, nor will they as a rule for any long period be the help that they should be to the one who is doing it. Rather will they discourage the patient in following his program, and urge him to break over for this and for that.

In the sanatorium, the patient is not only placed under conditions ideal for cure, but he is isolated.

He is removed from home and business with their interests and worries. He is taken away from solicitous and meddlesome friends. He is removed from much of the danger from acute respiratory infection which is found in the home from time to time. He is placed in an environment especially suited to his needs along with others who are trying to overcome the same disease. The moral support of others who have the same aim, who are living the same life and who are making the same sacrifices, is a tremendous factor in cure.

In the institution, the close association with physicians who practically live among their patients, and the optimism breathed by trained attendants, are also of great importance. If hygienic living in the open air, under careful supervision and hopeful surroundings with the application of such measures as an efficient dietary, properly regulated rest and exercise, hydrotherapy, heliotherapy, tuberculin, artificial pneumothorax, psychotherapy, and other measures for the relief of symptoms must be relied upon for the cure of tuberculosis, it readily can be seen that an institution, properly constructed and conducted, for applying these measures to the best advantage, must furnish superior conditions for their application.

The association between physician and patient in institutions gives an opportunity for an intimate

knowledge of not only the disease and its complications, but of the patient as an individual. It also gives the opportunity of applying useful therapeutic measures accurately instead of haphazardly.

The patient entering an institution should realize that he must subjugate his will to that of the physician. He must get in harmony with the spirit of cure. He must not consider his whims as necessities. He must recognize that the institution is a "spirit of hopefulness and helpfulness" and not a structure built of wood or plaster. It is his duty to catch this spirit and cooperate. The patient who dislikes program and discipline most, as a rule, is the one who needs it most.

There are two classes of patients in institutions, the one who is always avoiding negatives; the other, the one who is always grasping at positives. The former wants to do everything except those things which are specifically forbidden, but avoids doing them; the other, wants to know the things that will aid in healing, that he may do them. One is a negative, forced cooperation; the other is a positive, cheerful, intelligent attack upon the disease. It has been my experience that those of the latter type greatly exceed the former in number, consequently mould the spirit of the institution.

Some patients fear going to an institution because of a feeling that it is a gloomy and depress-

ing place to be. The opposite is true. There is no happier or more cheerful set of optimists to be found anywhere than in a well conducted sanatorium where patients are getting well of tuberculosis. It is a common experience that patients entering an institution are surprised at the general air of hopefulness and helpfulness and the lack of depressing influences. My patients often say: "I find it so much easier to get well in the institution than in the home. Here everybody helps. There everybody interferes."

In the sanatorium when a proper program is followed, time passes quickly in comparison with the home. The regime is not as dull and difficult of following. To see other members of the household going about their business, and enjoying social affairs while the patient is compelled to rest is often trying; while in a community where no one goes to business and where all have their own social affairs and all are occupied in getting well or in helping others do so, these deprivations are not felt to the same extent.

Some people fear a sanatorium, and think it is a place of great danger. Even physicians, now and then, warn patients in whom they suspect tuberculosis not to go into a sanatorium lest they should become infected. Nothing is farther from the truth. A properly conducted sanatorium is a

safe place in which to live. The danger of infection is removed by burning all sputum, and disinfecting all dishes, silver ware, glasses, napkins and bedding. Rooms are fumigated and cleaned after each patient leaves. These precautions are not taken anywhere else. No home, or hotel, or restaurant is as safe and free from danger of infection as a sanatorium. The fear of it is based on ignorance and is usually quickly dispelled by an inspection.

Patients sometimes say they are not sick enough to go to a sanatorium. This idea is wrong. Sanatoria are for the cure of tuberculosis. Early tuberculosis is the most curable, and all institutions should be filled with these favorable cases. Every patient with active clinical tuberculosis is suffering from a disease which demands the application of the most approved methods of treatment under the most favorable circumstances, if he would give himself the best chance of cure. These are found in a well conducted sanatorium.

## CHAPTER XXXV

## HOME TREATMENT

While the sanatorium, if properly conducted, offers the ideal conditions for the treatment of tuberculosis, yet we must recognize the fact that most patients who are suffering from this disease are obliged to be treated in their homes; consequently, it is necessary for physicians to familiarize themselves with the principles of treatment, and study the problems sufficiently closely to be able to surround the patient in his home with conditions as ideal as possible. To this end it is necessary to bear in mind that the condition which is often least difficult to supply is the one which is usually emphasized most—open air sleeping accommodations. The most difficult, on the other hand, and the most important, is to provide the patient with hopeful, helpful, cooperating influences. This requires a thorough understanding and training on the part of the attendants and those who must come in contact with the patient. The desiderata will be attained in a comparatively small percentage of cases. Few patients possess sufficient self-control, and the requisite degree of self-denial, to carry out,

unaided, a protracted regime amidst the distracting influences of the home; and few friends without training possess the judgement to associate with patients who are attempting to carry out such a regime, and afford them the moral support which is needed. The degree to which this aid is given depends upon the physician guiding the case. In my experience the patient is far more tractable than the friends and relatives. Too much emphasis is laid on the open air sleeping quarters, and not enough on the surrounding influences.

The home treatment of tuberculosis will be successful in direct proportion to the manner in which sanatorium principles are established and carried out. By the term "sanatorium principles" is meant a carefully planned program of hygienic living, personal hygiene, regulated rest and exercise, food provided to suit the needs of the patient, and other measures which are directed toward increasing the patient's vitality, and surrounding the patient with an atmosphere of cheer and hope.

There are two things to bear in mind in providing quarters for a patient in the home: first, the arrangement of the room, or whatever accomodations are occupied by the patient, in such a manner as to afford the greatest aid to recovery; second, the training of the patient so as to avoid scattering infection and transmitting the disease to others.

The room occupied by the tuberculous patient should be arranged so as to have free access to air and sunlight. Whenever it is practicable the patient should have an open air apartment. This can be arranged in many ways, according to the house occupied and the financial condition of the family. It may be very costly and be furnished expensively; or it may be simple, consisting of nothing more than a place to put a bed.

The particular factor of importance required in the sleeping accommodations for supplying patients with open air is not alone the size of the room and the amount of air or oxygen that it contains, but the freedom with which the exchange of air can take place. From the discussions on open air, and climate, it can be seen that the curative factor in open air is not alone the oxygen, but the physical action of air upon the surface of the body and the effect which it produces upon the entire organism in the way of relieving heat stagnation within the body. A room may be stuffy and still contain sufficient oxygen to carry on the functions of the body perfectly. It may contain a large percent of carbon dioxide and still produce no poisonous effects; but, unless the air in the room is in motion, it fails to stimulate the metabolic activities of the patient and fails to favor the proper elimination of heat, moisture and poisons from the body.

If it is impossible for the patient to have an open air sleeping apartment, the best should be made of the accomodations at hand. To this end a room should be used, if possible, where there is a cross-ventilation, and the bed should be put in the path of the moving air, rather than back in the corner out of the way of the air currents. Air currents are not harmful when the patient becomes accustomed to them. Where rooms with only one window must be used and where conditions are such that cross-ventilation cannot be had, patients should place their beds alongside of the window so that they may have as much of their body as possible exposed to the air as it enters the room.

The next important thing in arranging the apartment for the tuberculous patient is to see that the room is plainly and simply furnished. All unnecessary trappings and hangings should be removed. It is best that no carpet be on the floor. Curtains should not hang at the windows and there should be as little furniture in the room as is consistent with comfort. The room should be so arranged as to prevent the accumulation of dirt and infectious material, and so that it may be easily cleaned.

After accomodations have been supplied to the patient in such a way as to afford him the best application of the open air life possible under the circumstances, the next important problem is to

furnish him with helpful surroundings. The difficulty here is that the patient is the exception. Home activities are for the well. It requires sacrifices not only on the part of the patient but on the part of other members of the family in order to create the proper atmosphere and to afford the necessary help to the patient. It is the duty of the physician to explain this fully to the friends and members of the family, so that they may cooperate thoroughly toward the one end, that of keeping the patient interested in his treatment, and avoiding distractions, worries, and excitements of various kinds. This is one of the hardest things to accomplish. It is far more difficult than furnishing open air sleeping apartments, and it is no less important. The whole family must have confidence in the line of treatment and must be imbued with the necessity of aiding the patient to carry it out, otherwise failure is almost sure to result.

The friends as well as the patient must know that tuberculosis is a chronic disease which runs an uneven course. They, too, must be prepared for the exacerbations of symptoms which come now and then, and must be able to encourage, rather than discourage, the patient at these times. It is necessary for the physician to tell them what their attitude toward the patient should be, and see that he obtains support and encouragement in carrying out

his program. The patient must be treated as an intelligent being and must be expected to use judgment. If he does not, it is the physician who should correct him and not the attendants.

I have seen many patients driven almost to distraction by overanxious relatives and friends. Again, I have seen them throw away their chances of cure by following the advice of relatives and friends who tried to minimize the seriousness of their disease and urged them to do things which would prove harmful. Cooperation of all parties concerned is difficult to obtain, but indispensable to the highest degree of success. Whether this shall be obtained or not, will depend largely upon the physician.

The most important thing is to give the patient the correct mental attitude. He must be made intelligent. He must understand something of the nature of tuberculosis and the principles of treatment. He should know that tuberculosis is a disease that will yield to treatment, but that its cure is exceedingly difficult; and that this difficulty depends not wholly on the pathology of the disease, but partly on the inability to secure a proper cooperation on the part of the patient for a sufficient length of time to permit the tuberculous tissue to be converted into scar. He should be told that although the symptoms may all be gone, the path-

ologic changes are still not complete and that it requires a much longer time to convert his tissue into scar and secure a permanent arrestment. So that there shall be no misunderstanding, the patient should know that no matter if the physician should prescribe the best method of treatment and the patient should cooperate to his fullest extent, there is still a possibility that failure might result. Such cooperation, however, is the thing which is most conducive to success, and it is that which will often bring an apparently hopeless case to a favorable termination.

A daily program should be devised. The patient should begin and end his day at definite hours. Regularity is essential to best results. In the sanatorium, if the patient has not slept he prepares for breakfast at the same time, anyway. So should it be in the home. Putting off breakfast for an hour or two and permitting the patient to sleep gives the patient the rest; but, as a rule, spoils his breakfast and probably the remaining meals of the day. A patient can adjust himself to a regular regime and after a short time will fall into it naturally. Habit is one of the greatest factors in life and it is essential that the patient who is going to enter upon a course of treatment for a period of six or nine months or a year, should form the right habits at the outset. I tell my patients to first

arrange the hours for meals so that there is about five hours between them, thus 7:00, 12:00 and 5:00, or 8:00, 1:00 and 6:00. They should awaken half an hour or so before breakfast, and if their condition warrants it should take a sponge bath before breakfast. After breakfast they should be told what to do, which should differ according to whether the patient is wholly confined to bed or is permitted to exercise. If he is confined to bed, it is best for him to rest for a time. If he wants to look at the morning paper, or do a little reading, this is permissible. Sometimes he may be permitted to visit with his friends, but he should, as much as possible, stretch out the little things that he has to do, over the entire day rather than work intently upon any of them, or all of them, at one time. Absolute rest for a short period before luncheon should also be enjoined.

If the patient is able to be up and around he may occupy part of his time with exercise, the nature and amount of which is to be accurately prescribed by the physician. After luncheon it is best to have two hours set aside for rest. During this period the patient should sleep if possible unless this interferes with his sleep at night. If he does not sleep, he should learn to rest without reading and without visiting. Friends and others should leave the room and he should be left alone. Following the

rest, a little reading, crocheting, tatting, knitting or sewing, or whatever amusements are permitted, may be engaged in again for those who are in bed. Those who are able to be up and around may again resume their exercise. After supper I think it is best that little or no visiting be indulged in, and no outside friends be permitted to see the patient, because friends from the outside are rarely trained and are apt to use poor judgment in their conversation, and so produce excitement and worry. While things of this nature should be prevented as much as possible, they cannot be wholly eliminated; so they must be so controlled as to produce as little harm as possible. For this reason I think the visiting permitted the patient should be confined, when practicable, to the early portion of the day. This will nearly always guarantee better rest to the patient.

The hour for retiring should not be later than nine o'clock, and, in bed-patients, even earlier. No excuse should be accepted for not retiring at the appointed time. The patient can accustom himself to going to bed at one hour as well as another. There are a few exceptions to this, but the exceptions are usually based on a desire not to cooperate fully, rather than on absolute fact. It has been my observation that patients who are most prone to think that they cannot carry out a careful pro-

gram of this kind are the ones who need it most. They are the ones who are nervous and feel that they must be doing something. The best thing for a patient of this kind is complete relaxation and thorough rest for both mind and body. Such patients can often gain the best control of themselves by lying flat on their backs, without pillows, for two or three hours each day.

The patients should be instructed carefully regarding the danger of infecting others, rules for which will be found in Chapter XL.

## CHAPTER XXXVI

## THE TIME ELEMENT IN CURE

Few patients seem to realize what a factor time is in the successful or unsuccessful treatment of tuberculosis. The time when the diagnosis is made is all important. If it is made early, the patient has the best opportunity to recover. An early diagnosis, however, is of no avail unless it serves to direct the patient in the way of making a recovery.

The time of treatment, then, is just as important as the time when the diagnosis is made. Many a chance for life is thrown away because an early diagnosis is not made. Many more chances are thrown away because, when made, the patient is not given the treatment which is necessary to bring about a recovery.

The time element in treatment is no less important. It is not appreciated because the disease, as a rule, is so different from those diseases with which the patient is acquainted, that he does not appreciate the danger which exists. An early favorable tuberculous lesion may be converted into an advanced one in a few weeks. Unfortunately

the patient with early tuberculosis does not realize this. He usually feels fairly well; consequently he cannot appreciate the fact that, unless he undergoes suitable treatment which will conserve his strength and body forces, his disease may advance in a short time to such a degree that recovery is either difficult or impossible of attainment.

The patient may be given proper advice as to the things to do and the things to avoid, and he may follow this advice until health has been restored; but there is an important pitfall which proves to be the undoing of many which must always be guarded against, that is a failure to devote to treatment the time necessary for healing to be effected. The patient usually feels well long before his disease is healed. I have observed early cases of tuberculosis, in whom healing was not completed for more than two years. I have seen advanced cases secure a favorable result after two, three or four years. During all this time healing was taking place. Many patients fail to secure a result by stopping their treatment too soon. There is no given term of treatment. Its length must vary with the character and severity of the lesion, with both the natural and specific resistance of the patient and with the faithfulness with which the patient follows treatment.

I have seen many patients with early tubercu-

losis, who failed to secure a result in six months, win in eight or nine. I treated two patients with early tuberculosis intensively, most of the time in the Sanatorium, over a period of two years before their lesions were healed. At one year we would have failed; at eighteen months we would have been obliged to acknowledge defeat; but at two years we won.

I have seen moderately advanced and advanced cases win in a year and two years who would have failed in less time; I have known it to take five and six years to secure a good result in far advanced cases. No one can appreciate the curability of tuberculosis unless he has the opportunity of observing patients over a long time. It is a most hopeful disease if the proper treatment is prescribed and carried out long enough for a result to be obtained. It is a most hopeless one if a specified time say six months or nine months is going to be the rule of treatment.

If surgeons would report the results of their operations according to the time consumed in the operation it would be just as sensible as the way we have reported our cases in tuberculosis. How many patients would be cured of appendicitis if only the abdomen had been opened; how many after the appendix had been removed although the abdomen had not been closed; and how many when

the organ had been removed, the incision closed and the proper after-treatment had been instituted? Such a comparison while extremely ridiculous is not more ridiculous than reporting the number of cases of tuberculosis who have had their disease arrested in three months, six months or twelve months. The only sane method is to treat the patient until his disease has healed or until its healing has been determined to be impossible. Time is an essential in treatment, and since it is impossible to change the nature of tuberculosis, the time necessary to cure must be devoted to it or failure will result.

Not infrequently they cause themselves needless disappointment by making up their minds that they will be well on a certain date; and without consulting with their physician make their plans accordingly. There is no set number of weeks or months for treating tuberculosis successfully. Each case is a law unto itself; and no one can look ahead and say this case will be well on the twenty-fourth of June and that one on the ninth of December. Patients are particularly liable to allow the sentiment of holidays and the desire to be with friends at these times to interfere. It often requires much persuasion on the part of the physician to induce them to remain under treatment beyond a certain holiday, particularly when they are nearing the

end of treatment any way. They put up the argument: "I do not see why I will not get along just as well at home. I will do everything I do here," just as though it were new, unmindful of the fact that the physician hears it nearly every time a patient wants to take his case in his own hands, and has seen many who put up the same argument fail to make good. The very fact that the patient is unwilling to follow the advice at this time is fair proof that he will not when away.

Thus it may be seen that the time element is important in the cure of tuberculosis in these particulars: 1, the time when the diagnosis is made; 2, the time when treatment is begun; and 3, the time during which treatment is carried out.

## CHAPTER XXXVII

## TRAINED ATTENDANTS

What confidence is given patients, with such a many-sided disease as tuberculosis, by the presence of trained attendants! They have confidence because they know that they are surrounded by those who understand the disease and who know what to do no matter what the emergency.

The effect of this is apparent in any properly organized and well conducted institution. The patient who arrives as a stranger unacquainted with the atmosphere in which he is to be placed, knowing little of his disease except possibly that it is the "dread tuberculosis," feels a sense of inspiration and receives a stimulus to his courage as soon as he meets those who are to administer to him.

The atmosphere of the institution is created by those in authority. It is maintained by all of those who come in contact with the patients. It is something intangible, but it is the soul of the place. It is that which produces results. It is the thing which makes the institution worth while and makes it easier to get well within than without.

Trained attendants infuse confidence in the new-

comer and maintain it throughout his stay. The patient feels that no matter what happens, help is near; and this relieves him of worry and anxiety and helps him in his fight. The patient often meets a given symptom or complication for the first time; the attendants have met it often. He does not know what to do, but they do; and this gives him confidence and makes the fight easier.

The continuous presence of physicians, and nurses, who know how to care for the patients, who develop a judgment which shows in their actions and conversation, brings courage and stimulates a feeling of security and a determination to cooperate until a cure has been attained.

But even trained attendants are not perfect, and at times the patient will have his troubles. He will lose confidence in the physician. He will get angry at his nurse. No matter how foolish such a thing may be it will now and then happen. The patient always feels, too, that he is right, and that the other fellow is at fault. It is natural that he should feel so; but unless the matter is one of the greatest moment, such a course is foolish. Attendants cannot give their best service to those who do not have confidence in them, and who dislike them personally. The patient who does his best to cooperate, to be contented and happy and to help in his cure always secures greater aid from the

attendants than the one who is pessimistic, sarcastic, exacting and unwilling to cooperate. Appreciation shown to those who administer to the patient's wants will come back many fold in service rendered. Most patients will have times when the road is hard and beset with difficulties; but they will receive more help if they are naturally happy and contented than if they are inclined to be exacting and grouchy. Trained attendants who understand the disease and the effect that it has upon the patient are able and willing to make due allowances for temporary discouragements, and worries and for what at times seems to be unwarranted exactions or unreasonable fits of temper; but for the good of the patient such allowances should not often be made necessary.

The patient who thinks that he can make his way to cure by force and exaction, or who thinks he can purchase the aid of attendants regardless of his attitude toward them, fails to grasp the first principles which govern human nature. Kindness and consideration on the part of the patient toward attendants calls for the return of the same, often many fold. It makes it easier for those who can help to give the patient the aid that he so much requires.

The sick patient is often irritable and sometimes unreasonable, but can usually be guided and helped

out of this unfortunate state by tact on the part of the attendant. It is necessary for the patient to know that when one is ill of a disease like tuberculosis which causes so many discouragements, worries, disappointments and apprehensions; and which is accompanied by a chronic toxemia, that he might be more irritable than normal and that he might become angered more easily than when in health. If he understands this he is better prepared to fight against it, and save himself the annoyance and humiliation that often comes from failing to understand, and from allowing his angry passions to gain the upper hand.

## CHAPTER XXXVIII

## FRIENDS AND RELATIVES

If only we could harness the force and energy of the relatives and friends and have it work to the advantage of tuberculous patients we would be rendering them great aid.

It is natural to assume that relatives and friends want to aid the patient; but if we were to judge by results we would be obliged to admit that these good intentions often go wrong. Even in acute illness friends and relatives often hinder instead of helping, and how much more are they apt to do so in a long drawn out disease like tuberculosis, which is usually so little understood. It is necessary therefore for them to be trained to do the right things and to avoid the wrong things.

In the first place they should be made aware of the nature of the disease, so that they may know the course that it will probably take. While they should appreciate that advanced neglected tuberculosis is serious, yet they should be imbued with the optimism which the statistics of cure now warrant. They must be lead away from the gloom of past centuries and be imbued with the hope of the

present. They should realize that the condition or symptoms present on any one day or any small group of days rarely indicates the nature or the outcome of the disease. The patient may have a temperature of 101 degrees or 104 degrees today, he may be free from temperature within a week. He may have a rapid pulse, he may have digestive disturbances, he may be exhausted today, yet a week from today he may feel well. He may cough and expectorate more than usual today or may have a hemorrhage, yet in a few days all may be better, and the patient may go on to a healing. On the other hand, the patient may be free from temperature, have a normal pulse and digestion, and be free from cough and expectoration today, and a few days later may have an exacerbation of activity with a return of all of these symptoms. It is necessary for the friends and relatives to know of the ups and downs in the disease, to know that they are an integral part of the disease, that they belong to the game that the patient is playing. The freedom from symptoms on the one hand does not mean that the patient is well; neither does the return of symptoms on the other mean that healing is not progressing favorably. It is not what occurs on one day or in one week but it is the general trend of things that must be considered. It is not easy to realize that cavity formation with the accom-

more than he knows himself. The training of attendants and the creation of a helpful, hopeful atmosphere among them is far more difficult than providing suitable food and out of door sleeping accommodations; yet it is a very important part of the treatment.

Members of the family are often prone to visit with the patient too much. This is especially true in the home. It is also common where friends are near a sanatorium. Sanatorium patients as a rule do best when their relatives and friends visit them infrequently. Friends should shield the patient as much as possible from all worries and anxieties and they should shield him from expending the energy, which is so badly needed for fighting the disease, upon trifles. They should also avoid trying to entertain him all the time. He is best when he is not bothered so much. The question of cure is one of conservation of energy. In order to win, the patient must make the energy that is required to care for the ordinary wear and tear of the body plus the extra wear and tear caused by the disease process. Conversation, especially if animated, worry and anxiety all use up energy; and if a sufficient amount of it is used in this manner, there may not be a sufficient amount left to heal the process. Often times the cure of tuberculosis is accomplished by a very small margin. I often feel,

if only I could raise the patient's resistance ten or even five per cent that he could win. This is a disease in which little things count. There is no great big outstanding remedy upon which we can rely, but many measures each of which will add from five to twenty per cent to a given patient's chances. Therefore it is essential for those who come in contact with the patient to remember that they cannot subtract many per cent from the patient's chances without running great risk of disaster.

## CHAPTER XXXIX

## MARRIAGE

Should tuberculous patients marry? No matter whether they should or should not, some of them will; therefore they should understand the best thought on this subject.

Tuberculous patients who have not already a love affair should avoid having one until after they have secured an arrestment of their disease. We often see lives sacrificed by the extra cares thrown on a patient by his or her falling in love. This is a time when all the forces of the body should be summoned and utilized to build up strength and resisting power, and all distractions and unnecessary strain should be avoided.

For those who are engaged, as a rule it is best to postpone all thought of marriage until two years after the disease has become arrested. We set two years, because experience shows that it requires about two years to make an arrestment permanent, and it is wisest that no extra burdens or cares be taken on during that time.

In some rare instances, however, where a patient marries in such a manner as to improve his or her

condition and to relieve care and worry this rule may be set aside. But it is a safe working rule and should be followed in most instances.

There are several reasons why marriage is not advisable except under the circumstances here named, which we shall now proceed to discuss.

From the standpoint of children being born with the disease there is the least danger, although this is the one that patients often think of first. A tuberculous mother or father may have a perfectly healthy child. Children are not born with tuberculosis, except in sufficient instances to prove it a possibility. The real danger to the child is to be born into a home where there is open tuberculosis. Here on account of the intimate contact with bacilli the child often becomes infected with so many germs that acute tuberculosis develops at once; or so that the child later develops an active disease. When children are born in such homes they should be kept away from the rooms which the patient frequents, and should be shielded from other methods of contact.

Man often improves his chances of keeping well by settling down after marriage, but he has to face the extra expense incident to keeping his wife and maintaining a home. This is often the factor which interferes with his completing the healing. The period when the patient is fighting tuberculosis

is not the time to assume new responsibilities. The patient must also keep in mind that his period of reduced earning capacity does not end with the period of treatment; he must not work to full capacity for a year or two after arrestment has been completed.

It is to the tuberculous woman, however, that marriage offers the greatest danger. Not only does she take on the added responsibilities of maintaining a home for her husband, but she also assumes the risk of child bearing. No woman should become pregnant while suffering from active tuberculosis; and it is especially desirable that this should not be until a lapse of at least two years after an arrestment has been attained. During pregnancy women often feel exceptionally well. They gain in weight and strength and think that they are gaining mastery over their disease. But after confinement quite a proportion will lose strength and soon show symptoms of an active disease. If they stand the first pregnancy well, they are apt to break down with the second or third.

Tuberculous women who have not been advanced in the disease may bear children after two years has elapsed from the time of arrestment without great risk, provided they receive the best of attention and care during and after the pregnancy. But they should be satisfied with one or two chil-

dren. Repeated child bearing is very prone to be disastrous. A woman who has suffered from advanced tuberculosis and who has had a hard struggle to regain health, would be much safer not to bear children at all.

The mother should have the best care not only during the pregnancy but after the child is born. It is inadvisable for the mother to nurse the child, or to have the care of it. The extra work, the disturbed sleep and the anxieties incident to the child's care, are prone to reduce the mother's resistance and cause her to have a relapse of her disease.

The patient with tuberculosis should know that when he or she gets over the disease it is possible to marry without great risk, provided certain rules are followed. He should also understand that this subject had better not be voluntarily taken up for serious discussion during treatment, unless it is already under consideration. All questions of marriage, except in the rarest instances, should be postponed until a result has been attained, and maintained long enough to prove its permanency.

## CHAPTER XL

## GENERAL AND PERSONAL HYGIENIC PRINCIPLES TO BE FOLLOWED BY THE TUBERCULOUS PATIENT

While the patient suffering from tuberculosis is struggling to overcome his disease he should not think of self alone. He should consider what he can do to avoid giving the disease to others. Remembering that most of the tuberculosis affecting human beings is transmitted to them from some other human being who had the disease, he should make it his duty to see that he does not give it to any one else.

We now know sufficient about tuberculosis to enable us to formulate rules for those who have the disease and for those who associate with them, which, if followed, will remove practically all of the danger that comes from the tuberculous and nontuberculous associating together.

It is not the tuberculous patient, but the patient ignorant of his disease; or, knowing it, who refuses to follow hygienic rules, that endangers the lives of others. On the other hand, the one who knows

and takes the necessary precautions is a safe companion with whom to live. This fact is very comforting to both the patient and his friends. It removes him from the class which must be avoided, but it at the same time places largely upon him the burden of prevention. Think what the isolation would mean to patients and friends during the many months of illness, if tuberculosis were as infectious as diphtheria and smallpox!

Hygienic rules governing tuberculosis are of two classes: 1, those which pertain primarily to the patient himself; and 2, those which pertain to his duty towards others. These rules dovetail into each other so much that they must be discussed without an attempt at segregation.

The patient with tuberculosis should spend as much time in the open as possible. This not only gives him the benefit of the curative effects of open air, but whatever bacilli escape destruction are killed more quickly in the open and are less prone to infect others than when confined to an enclosed space. Direct sunlight kills bacilli in half an hour if in a dried state, diffuse light in a few hours; but in a damp, dark room they will live for months.

A given mass of sputum might contain millions of bacilli. If this should dry and be diffused into the air of a small room it would be dangerous particularly to a child should it inhale it; but if di-

luted with outside air, the danger would be relatively small. It is entirely improbable that an adult could be infected with street air. This statement must not be taken as a basis for carelessness in expectoration, for here other dangers come in. When one expectorates on the ground a pedestrian may carry it into the house on his shoes or other article of clothing that might become soiled, and infect the house. This is especially dangerous if children are in the home; or a child, as some of us have seen, soils its hands and clothing direct and then transfers the bacilli to its mouth. So patients living in the open air must be conscientious in the disposal of their sputum, the same as though they were inside.

Sunlight should enter the room or apartment occupied by a tuberculous patient as freely as possible; diffuse light should reach every nook and corner; and the air should circulate freely through it. The furniture should be simple and consist of as few articles as will meet the needs of the patient, and hanging curtains and other trappings which gather dust should not be allowed.

Some patients like to keep their rooms filled with useless and unnecessary articles. By so doing they do not only make it more difficult for those who are responsible for cleaning, but they make their rooms

less sanitary for themselves and those who visit them.

The danger of infecting others lies chiefly in the secretions from the lung of the patient suffering from pulmonary tuberculosis; but the secretions of all tuberculous organs should be carefully destroyed.

The dried sputum and the spray of sputum which is thrown out while coughing and sneezing are the chief sources of infection. The breath is not infectious.

The danger from the spray is reduced by patients learning to repress cough as much as possible, and by covering the mouth with a paper napkin which after being coughed into should be folded up with the soiled part turned in. These then should be put into some receptacle,—a paper bag pinned to the bed in a convenient place serves the purpose admirably,—and collected at frequent intervals and burned.

It is not so hygienic to cover the mouth with the hand or a handkerchief, for both of these methods scatter infection, as can be readily understood.

The sputum or other tuberculous secretions should be gathered and destroyed. Where one is provided with adequate fire, the best way of caring for the sputum is to collect it in *covered* pasteboard boxes and then have it burned. When this is not

practical the sputum may be collected in porcelain or other sterilizable containers, always with a lid, and then be poured into the sewer, the container being sterilized frequently. Spitting in cloths and on paper on the floor is not to be countenanced. When patients are walking or whenever they are away from their quarters, they should either use the collapsible cup or paper napkins. Patients should never expectorate on the ground.

Towels, napkins, bedding and linen which are disinfected by washing and ironing are not infectious. Soiled bedding or clothing should be immediately disinfected.

Two rules for the care of sputum should be rigidly adhered to by the patient: 1, it should be kept covered so flies cannot come in contact with it; and 2, it should be kept moist until it is destroyed.

Patients should exercise care not to swallow sputum. While nature destroys most of it yet there is danger of it infecting the bowel.

Patients with tuberculosis should not kiss on the mouth. This is especially dangerous when the patient has open tuberculosis. The greatest danger is in the morning when the cavity secretions are being coughed out. The danger can be partly removed by brushing the teeth and rinsing the mouth thoroughly with some antiseptic such as carbolic acid 2 - 4 per cent. Even when every precaution

has been taken patients should not kiss children on the mouth; in fact, nobody sick or well, should kiss a child on the mouth.

The teeth should be cared for carefully in tuberculosis. They show a tendency to soften during this disease, so they should receive special attention. They should be brushed after each meal so that no particles of food may be allowed to decompose about the roots. Aside from this the mouth should be cleansed frequently with some antiseptic mouth wash. The mouth should be cleansed before every meal.

Dishes used by the patient should be kept separate from those used by the rest of the family as long as bacilli are found in the sputum. They should be scalded; or better, boiled after each meal.

Children are far more prone to become infected than adults. Adults have as a rule, in fact we might almost say always, come in contact with bacilli before, which have acted as a vaccination and given them a certain amount of immunity to the disease; but the child has not yet become protected or has not become protected to the same degree and consequently is more susceptible. For this reason children should not come in contact with open tuberculosis. When the disease is in the family, children should be kept from playing on the

floor or on the bed or with other articles that may be soiled.

Tuberculous patients with open disease should not play with children in any way which necessitates contact, particularly should they not play with their hands, kiss them, or cough over them.

Patients with tuberculosis should sleep alone and in a separate room if possible.

Tobacco does the patient no good and some harm, therefore should not be used. Tobacco adds a substance which has a tendency to destroy a nerve equilibrium which is already badly disturbed. Smoking also proves to be an irritant to many throats; and chewing is to say the least filthy.

It is difficult for a patient addicted to the use of tobacco to discontinue it, and I have observed that those who find the greatest difficulty in stopping the use of tobacco when advised to do so for their health, usually have difficulty in cooperating in other particulars.

## CHAPTER XLI

## THE CHILD AND TUBERCULOSIS

Much has been said about the child and tuberculosis throughout these pages; and it will be readily appreciated from the discussion that the child is the key to the tuberculosis situation. Stop tuberculosis in the child, or reduce the danger of infection to a minimum and tuberculosis in adults will decrease.

Tuberculosis is not inherited, but infection begins to take place soon after the birth of the child, because it soon comes in contact with tubercle bacilli which are scattered widely and met under many different circumstances. The opportunity for infection is so great that nearly all of the poor children dwelling in the city, and a large, though smaller, percentage of those in more comfortable circumstances and those who live in the country, are infected before they reach the age of fifteen years, as discussed elsewhere in these pages.

Tuberculous infection is most common among the children of the poor, because they suffer from a lower state of nutrition and huddle more closely together, thus showing a lesser resistance and a

greater opportunity for contact. It occurs, however, in all walks of life regardless of social and economic conditions.

The main sources of infection are: 1, some person who is suffering from open tuberculosis and expectorating tubercle bacilli; 2, dairy cattle suffering from tuberculosis.

It is impossible to enumerate the many ways in which bacilli are transmitted from the patient who is expectorating them to the individual who receives them. While it is quite true that the greatest susceptibility to infection is in the first two or three years of life and the greatest danger occurs when a little child associates intimately with a person with open tuberculosis; yet this will, by no means, account for all infection. Infection probably may occur during any period of life, although it would seem that infections after the time of childhood must be comparatively rare, and that they must take place only when the individual comes in contact with enormous numbers of bacilli over a prolonged period of time. It is probable that if the danger of infection could be kept at a minimum until the individual reaches the age of 15 years that the infections occurring after that time would be exceedingly rare.

Since children who do not associate with open tuberculosis also become infected we must assume

that there are other very common sources through which the bacilli are distributed. In this we must not forget the fly, food prepared by tuberculous people and probably clothing and other articles which might be infected as they pass through the hands of those suffering from open tuberculosis. If the only source of infection were through immediate association with the tuberculous patient, and milk which comes from infected cattle the subject would be comparatively easy.

Little children should not be allowed to play in rooms occupied by a patient suffering from open tuberculosis. While the danger is largely removed if the patient lives in the open air, covers the mouth while coughing, disposes carefully of all expectoration, and destroys or disinfects all soiled handkerchiefs and pieces of clothing; yet even under these circumstances it is not wise for children during the first two or three years of life to be in a room occupied by a coughing tuberculous patient.

The younger the child the greater the danger of infection. The child is born with a certain degree of natural resistance against infective microorganisms, but in order to have a high degree of resistance he must develop a specific defense by taking the disease producing germs into his body. If he takes many into his body at one time disease is almost sure to follow; but if he comes in contact

with only a few at a time he overcomes them and develops an immunity.

The child being more or less helpless spends its time on the floor which is the most contaminated part of the room; and from its habit of putting its fingers and other soiled or infected things into its mouth, the opportunity of becoming infected is greatly increased.

Dust from floors, walls and ceilings of rooms occupied by patients suffering from advanced tuberculosis have been examined for tubercle bacilli and it has shown that most of the infection is confined to the floors and the lower two feet of the walls. This is the environment in which the child spends its early years and it is self-evident that the danger of infection in the presence of a case of open tuberculosis is extremely great.

The evidence of the greater danger in families with open tuberculosis, as compared with families free from the disease, is shown as follows: 1, by a greater proportion of the children living in such families becoming infected before a given age; 2, by a greater proportion of these children dying of active tuberculosis during their early years; and 3, by a greater number of these when they reach adult life, breaking down with active clinical tuberculosis.

When the mother has open tuberculosis the child should be removed, and kept separate until her

sputum is free from bacilli. She can be allowed to play with the child with safety, however, if she washes her hands, puts on a newly laundered garment over which she has not coughed, and refrains from coughing during the time.

We have spoken of the danger from dairy herds in Chapter III and will not repeat here, except to say that the danger from infected milk may be much greater than is generally believed, and the child should be guaranteed pure and wholesome milk products.

These early infections in children are of great importance from several angles; 1, in many they immediately produce active tuberculosis which goes on to the destruction of the child; 2, in case a widespread, active lesion does not follow, the infection may remain partially active and throw out toxins which injure the nervous system and interfere with the growth and development of the child; and 3, these early infections may remain dormant for a number of years and then produce the active clinical tuberculosis which is found in adult life.

While we cannot conceive of any known measures being sufficiently effective to wholly prevent infection from occurring, yet if the measures which are known to be effective were adopted it would cause the infection to be produced with few instead of many bacilli. This would be a great advantage to

the child, because it would overcome the infection more readily; and any infection overcome or held in check creates within the child an increased resistance or immunity to further infection by the bacilli.

The first infection in children involves the lymph glands. This is probably largely responsible for the fact that the disease is held in check; for the lymphatic system furnishes the child with its strongest defense during its early years. Bacilli, when once settled in the lymph glands, are often prevented from multiplying, and usually prevented, for the time at least, from escaping and infecting new tissues. This original infection becomes temporarily quiescent; but not until it has gradually accustomed the body cells to the poisons produced by the bacilli and raised the child's resistance, or immunity, to further attacks of the bacilli.

It is very important to recognize the effect of an early semi-quiescent tuberculosis upon the growth and development of the child. The toxins which gain access to the blood stream injure the nerves and make the child irritable, interfere with his growth, and destroy the physiologic balance in his various organs. Children who do not develop properly, particularly if there has been open tuberculosis in the family should be examined for tuberculous infection. While all such children

are not suffering from tuberculosis, yet enough of them are to cause the disease to be taken into serious consideration, whenever such symptoms are present.

Another common condition, which is often due to an active tuberculous infection of the lymphatic glands at the root of the lungs, is a tendency to colds or bronchitis. These children are usually operated on for enlarged tonsils and adenoids. They may be relieved in part by these operations, but often the symptoms continue. Such children should be examined for enlarged bronchial and trachial glands as well as for diseased tonsils and adenoids.

Children who have active tuberculosis have chances of overcoming their disease in many instances. The chances vary with the location of the lesion, the severity of the process and the age of the child. The older the child the better the chance of recovery. It has been shown that during the first two years of life practically all children who are infected with large numbers of bacilli and develop clinical tuberculosis die of the disease. After this time children begin to show more resistance, and by the time seven or eight years has been attained considerable resistance is already manifested.

The more chronic types of this disease affecting

such organs as the bones, joints, glands and lungs, offer excellent chance of relief. Children suffering from these types of the disease should be put under proper treatment at once on the diagnosis being made and continued until a result has been obtained. Children from the age of seven or eight up to puberty usually respond well to treatment; and care given at this time will nearly always assure an arrestment of at least the milder forms of the disease.

Children who suffer from these mild types of the disease should not be forced in their school work. They should be privileged to attend open air schools. They should be encouraged to live and play in the open and should be supplied with ample food. They usually react well and if given the proper care will usually be restored to health.

## CHAPTER XLII

## GAMES, SPORTS, AND OCCUPATION

One of the difficult things in treating tuberculous patients is to keep them occupied and contented during the long period necessary for treatment, without permitting them to do things that are actually harmful.

Some patients are wholly capable of entertaining and amusing themselves and do not feel the restraint and isolation which must necessarily be imposed upon them, while others are less independent and must look outside of themselves for entertainment.

Every program for the treatment of tuberculosis should bear these differences in mind. The patient must be kept busy either doing nothing or doing something. The program of activity of the doctors, nurses and attendants can be arranged in an institution in such a manner that the patient's time is occupied although he really does little or nothing.

During the period of bed treatment, frequent visits of attendants to the patient, or their presence in an adjoining room or corridor helps to relieve monotony. During this time the patient is

relaxing and resting. He must learn to conserve his strength. He or she, as the case may be, may be allowed to do such things as read, write letters, sew, knit or tat, provided it is done without tiring. A good plan is to do things for ten or fifteen minutes and then rest a like time or longer. In this way the patient relieves the monotony without tiring.

Card games, checkers and chess may be played where the patients are convalescing. Solitaire helps many a patient to pass the time away. The only danger in such games is that of tiring, which may be avoided by not beginning them until the patient is really able, and by not playing them too long at one time. This the physician must determine.

When the patient is on exercise what games are allowable? There are many things that could be done provided patients would exercise good judgment, that cannot be permitted because of a knowledge from experience that many of them will not. Tennis is too strenuous to be considered. Golf unfortunately presents the combination of intense interest and a long walk in a competitive sport. I have found that patients become so enthusiastic that they forget that they are ill and soon make the game primary and their treatment secondary. Scotch bowls is an interesting out of doors game,

but unfortunately it is played very little in this country. It is particularly suitable to those who are well arrested. Croquet is the best of sports. While it often leads to heated arguments; yet if the amount of playing is limited it is delightful and admirably suited to the strength of the patient. Bicycling is too strenuous. Auto riding affords diversion, but it soon leads the mind away from the essential program of cure. Horseback riding is much the same, but an excellent exercise after healing has taken place.

Walking seems to me to be the best of all exercises for the tuberculous patient during the period of active treatment. It can be measured accurately according to the patient's ability to do. If the walks can be in the country or mountains it adds much to the interest. But walking can be suited to the patient's physical requirements in any place. It has no competitive phase. It can be combined with nature studies where practical. Studies of birds, flowers, fruits, trees, and kodaking add to the interest of walks and have another very important function; they aid the patient in getting back to constructive work after his long period of inactivity.

No matter what the game or sport engaged in, it should always be under the supervision of the physician; and the patient must take it for what it is intended. Too often patients feel that as soon as

they are able to walk two or three miles, or play games without producing symptoms, that they are masters of the situation and might as well take their treatment in their own hands. No mistake could be greater. The physician knows the danger, but the patient often will not see it. The patient should remember that time is the essence of cure. He can go only so fast, in his healing; and it is necessary to complete it under guidance or the chances are that he will not complete it at all.

Let all sports and games and all diversions be looked upon as an important and essential part of the treatment, if the patient would get most out of them. It requires more skill to adjust exercise to the patient than almost any other measure that we use, for this is the point where health is either made or the chances ruined.

Many institutions, mostly public, are now conducting classes in vocational training. This is a splendid thing from the social and economic standpoint. By this means patients without means of livelihood are often trained to some useful means of earning a living and others are trained to do work that is easier than that of their former trade. This can be made a part of the exercise program and at the same time a practical aid to the patient.

Tuberculous patients were formerly almost universally advised to seek some outside employ-

ment with little regard to its character or their fitness for it. The fact that it was outside seemed to satisfy the mind of the one giving the advice. Like most general advice this often proved disastrous.

What occupation a patient shall follow when he is able to work is as much an individual question as the amount of exercise he shall take.

In deciding this question there are several factors to be considered. In the first place there are sixteen hours for the patient to spend out of doors, provided he sleeps out, after his day's work is done; secondly, if the patient does the work he is accustomed to do easily, it is often much better to continue it rather than take up something new; thirdly, if his former work guarantees him a living it is often better to pursue it rather than take up something which might appear to be more suited to his condition but which carries with it the worry about making it a success. This is well illustrated by the advice which is often given patients on leaving the east for the southwest: "Go out there and raise chickens, and keep in the open." Chickens are hard to raise and many a tuberculous patient has sunk all his savings in trying to raise them; and, failing, found himself much worse off than he would have been had he followed what seemed to be a less healthful occupation.

Unless there is some particular reason to the contrary a good rule for an expatient to follow is to do the work he is accustomed to do, if he does it easily and then live right the time he is not working. As many tuberculous patients are killed outside of working hours as by the work they do.

## CHAPTER XLIII

## CURE

The trend of scientific opinion is against the use of the term "cure" in tuberculosis. This is wise from the standpoint of impressing upon the patient that tuberculosis heals with the bacilli still in the tissues. It impresses upon him the fact that his enemies are still with him and that he has a part in preventing them from again causing an active disease.

It is unwise from another psychological standpoint for it causes people to believe that tuberculosis cannot be successfully combated. One of the most unfortunate factors in the fight against tuberculosis has been the pessimism which has been attached to it throughout the ages; and, unless this attitude toward the term "cure" is properly understood, it will foster the pessimism which it is so desirable to combat.

If only we could establish firmly in the minds of the race the fact, which has been thoroughly proven, that tuberculosis is a disease which will yield readily to treatment, provided it is applied

efficiently and at the proper time, we would be making one of the most important advances that could be made in combating this disease.

It is of little real difference to the patient whether his condition is termed "arrested" or "cured," provided this desired result is secured and maintained. When the real true meaning of "arrestment" is understood it is not discouraging. It means a clinical healing. It means that the patient has overcome the activity of the process. In early cases, provided the patient lives right, it usually means a permanent recovery, and so amounts in the great percentage of cases to the same thing as a cure.

It is in the more advanced cases that the danger of renewed activity is greatest. In the tissues of those recovering from widespread and seriously destructive lesions many bacilli are imprisoned which under circumstances unfavorable to the patient may become active. So in these cases the term arrestment is particularly applicable and suggests the necessity of after-care.

In all stages of the disease, however, if patients will give sufficient time to treatment and then follow out the proper program afterwards, arrestments, attained, may be made permanent in a very

large percentage of instances. An arrestment, maintained for two years, may usually be looked upon as permanent provided the patient lives within his strength and follows the rules of hygienic living. At this time the patient is called "apparently cured."

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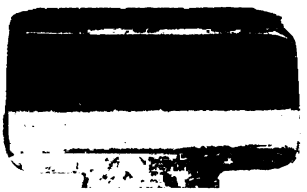
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